Evaluation of the Wadden Sea Particularly Sensitive Sea Area (PSSA)

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Executive Summary

The purpose of this document is to present the high level outcomes for the evaluation of the effectiveness of the Wadden Sea PSSA, seven years after its designation by the IMO. Key changes with regard to IMO and EU shipping policy are identified and described, followed by a review of 'expert' opinion focused on the issues relating to PSSAs. The development of an evaluative framework and the resulting findings are introduced and discussed in context. Using existing data against this evaluative framework we conclude that six key elements require action in order to fully describe the efficacy of the designation, and our recommendations to address these concerns are presented.

1. Shipping related regulations and policy

IMO

Since 2002 three major Conventions related to shipping and the marine environment have come into force, along with the introduction of a new MARPOL Annex and amendments to existing annexes. Furthermore revised Guidelines for the identification and designation of PSSAs were adopted in 2005. These include: *Resolution A.982 (24).* Revised guidelines for designation of Particularly Sensitive Sea Areas; *MARPOL 73/78*: Amendments to Annex I and Annex IV and the entry into force of Annex VI; *The London Convention Protocol 1996* (In force 2006). Ancillary to the London Dumping Convention 1972; *The Protocol on preparedness, response and co-operation to pollution incidents by hazardous and noxious substances 2000* (OPRC-HNS Protocol) (In force 2007); *The International Convention on the Control of Harmful Anti-Fouling Systems on Ships* (AFS) (In force 2008). The following Conventions have also been adopted but are not yet in force: *The Nairobi Convention on Removal of Wrecks* (adopted 2007); *The International Convention for the Control and Management of Ships Ballast Water and Sediments* (Adopted 2004); *The Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships* (Adopted 2009)

EU Policy

The Third Maritime Safety Package entered into force in 2009 and contains 6 Directives and 1 Regulation: *Role of Port State Control* (Directive 2009/16/EC); *Compliance with Flag State requirements* (Directive 2009/21/EC); *Common rules and standards for ship inspection and survey organisations* (Directive 2009/15/EC); *Establishment of community vessel traffic monitoring and reporting system* (Directive 2009/17/EC); *Fundamental principles for investigation of accidents in the maritime sector* (Directive 2009/18/EC); *Liability of carriers of passengers* (Regulation (EC) No 392/2009) and *Insurance of ship owners for maritime claims* (Insurance Directive 2009/20/EC). Additionally the EU has also developed an *Integrated Maritime Policy* that has an associated instrument for *Marine Spatial Planning.*

2. Expert focus group

A group of experts in PSSAs and related matters was identified and invited to provide its views on key elements which were perceived to be of importance with regard to PSSA development, effectiveness and legislation. Key areas identified as being important were: Function of PSSAs as a protective mechanism; Appropriateness of existing designations; Legal and regulatory framework; Stakeholder awareness; and how to measure effectiveness of a PSSA?

Development of evaluative framework

The views of the expert focus group in conjunction with those of the project team were utilised to create an evaluative framework that could be used to measure the effectiveness of the Wadden Sea PSSA. A pressure-state-response approach was taken where key indicators were identified. These were:

Pressure: Shipping volume (type), shipping incidents, Collision – low impact, collision – high impact, oil spills reported, oil spills by type/volume/coverage, offshore development, dredging **State**: TBT and invasive species. **Response**: Development of APMs, Communication to mariners, co-ordination between states, oil spill response, stakeholder awareness.

3. Review of existing data

In accordance with the Terms of Reference existing data and risk analyses were to be utilised within the project. The majority of environmental and ecological information was obtained from the Trilateral Monitoring and Assessment Programme (TMAP). Whilst there was an extensive range of data, lack of coherence, continuity and sharing of data limited its value of the data within this evaluation.

Shipping data was provided by all States; however the quality and quantity varied greatly and was not readily available. The limited availability and/or lack of shipping data proved problematic. Furthermore much of the data lacked sufficient detail or was too vague to be utilised effectively. However data that was available, when plotted onto a GIS model, demonstrated that the inner traffic separation scheme and approaches to the Elbe experience a higher level of incidences than may be desirable.

Stakeholder knowledge and understanding of the function and purpose of PSSAs was obtained through the use of a questionnaire. The project steering committee assisted with this task by contacting stakeholders in their home countries. The results of 88 responses that included mariners, pilots, salvage experts; government officials and environmental officers indicated that knowledge of PSSAs, particularly their function and location was poor or very limited.

There is insufficient data to support the view that the PSSA designation has been responsible for either an improvement or deterioration in the quality of the environment of the Wadden Sea area. This is mainly due to there not being enough appropriate data collected by monitoring teams that directly links with the purpose and function of the PSSA concept.

4. Recommendations and future measures

1. The current PSSA designated area should be extended to include the inner traffic separation scheme and approach channels to the ports.

2. There should be extended co-operation and collaboration between the CWSS, DenGerNeth and Bonn Agreement to enable a more comprehensive and cohesive management approach to be adopted.

3. Collection, interpretation and sharing of environmental and ecological data within the Trilateral Monitoring and Assessment Programme (TMAP) should be brought into line to enable a more cohesive and effective monitoring programme. Data that directly pertains to shipping should be collected as part of the ongoing TMAP evaluation and reporting programme.

4. A central shipping incident reporting database should be developed specifically for the Wadden Sea PSSA. The reporting criteria should at a minimum include clear geographic co-ordinates (Lat/Long), an estimate of area covered (for oils spills/slicks), a classification of incident type and any resulting action taken. Pertinent data could then be incorporated within TMAP.

5. There should be a concerted effort amongst all States to raise the level of *awareness and education of the PSSA and its function amongst all stakeholders.* Consistent, appropriate and adequate promulgation of the PSSA *t*o mariners should be addressed.

6. The development of a TSS along the shipping corridor from the Weser/Elbe into the Danish sector to the North should be considered as a possible future APM.

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INTRODUCTION

Shipping provides the global arteries of commerce, through which an estimated 85% of world trade is undertaken. Furthermore shipping and ports can also be seen as major drivers of globalisation and economic prosperity. More importantly it is also one of the most environmentally benign forms of transport when regulated and monitored appropriately. However shipping and maritime activities can also place extraordinary pressures on fragile ecosystems particularly with respect to pollution as a result of collisions and accidental or deliberate discharges. In order to address these issues, whilst at the same time ensuring that shipping can continue to contribute to the economic development and prosperity of countries, the International Maritime Organisation has been responsible for developing and implementing various conventions and legislation to enhance both safety of shipping and marine environmental protection. A major instrument available help protect fragile and sensitive ecosystems which are vulnerable to shipping and maritime activity is through the designation of an area as a Particularly Sensitive Sea Area (PSSA) under the auspices of the International Maritime Organisation (IMO).

The benefits of a PSSA designation include the ability to provide a comprehensive management tool, where specific vulnerabilities of an area to damage by shipping can be addressed through the adoption of IMO measures, providing global recognition of the special significance of a designated area through identification on hydrographic charts and allowing coastal states to adopt additional measures to address specific risks associated with international shipping (Roberts, 2007).

The Wadden Sea and adjacent North Sea are one of the busiest maritime areas of the world with several major ports that are great importance with respect to maritime trade and economic prosperity. Additionally the Wadden Sea itself is a worldwide unique nature area. In October 2002 the Marine Environment Protection Committee (MEPC) of the IMO, designated major parts of the Dutch, German and Danish Wadden Sea as a PSSA. The area designated as a PSSA is basically the marine area of the Wadden Sea Conservation Area, being the Wadden Sea national parks in Germany and the Wadden Sea nature protection areas in Denmark and the Netherlands, covering an area of approximately 15,000 km^2. The Wadden Sea and adjacent the North Sea was already subject to an extensive regime of protective measures, consisting of both International and National regulations, aimed at reducing the impacts from and risks related to shipping. Therefore, the PSSA designation was not associated with new measures.

At the Wadden Sea Conference on Schiermonnikoog, 2005, Ministers further declared their determination to protect the Wadden Sea from the negative impacts from shipping (§14 Schiermonnikoog Declaration). Following this conference it was agreed to evaluate the effectiveness of the Wadden Sea PSSA, before the 2010 Wadden Sea Conference. With respect to this agreement the aims of this report are as follows:

- To evaluate the effectiveness of the Wadden Sea PSSA, and in doing so assess whether the designation has contributed to the specific protection of the area from the impacts associated with shipping.

- To ascertain whether the current PSSA designation needs to be enhanced either in terms jurisdictional area and associated matters, or with regard to the adoption and implementation of additional measures.

To achieve this, the objectives as set by the Terms of Reference are:

- To review the revised guidelines for the identification and designation of PSSAs as adopted by the MEPC of the IMO since the designation of the Wadden Sea, as well as other shipping regulations, in the context of their relevance to the evaluation.
- To undertake a risk assessment of the impacts resulting from shipping both within and outside the PSSA boundaries; and relating to both accidental and intentional pollution; operational discharges; and, and physical damage to marine habitats and organisms.
- To review the results of the risk assessment with the Steering Committee in order to identify areas where further protective measures may be required and to identify possible measures as solutions.
- To draw conclusions and recommend actions that will enable clear policy to be formulated for the continuing and enhanced protection of the Wadden Sea PSSA

Structure of the report

This report presents strategic information and recommendations in accordance with the research aims above.

Chapter 1 examines any changes in the guidelines for designation of a Particularly Sensitive Sea Area and also identifies changes in shipping legislation and policies both at International and European levels since 2002.

Chapter 2 examines the responses from the expert questionnaire.

Chapter 3 sets out the methodology used in establishing the evaluative framework; identifies key indicators and then examines in detail each of the key indicators used within the evaluation. This chapter also includes a review of the existing data.

Finally, Chapter 4 draws together the results and findings of the previous chapters and presents recommendations.

1.0 Shipping related regulations and policy

1.1 IMO

Since the designation of the Wadden sea as a Particularly Sensitive Sea Area (PSSA) in 2002 a number of IMO Conventions and Regulations concerning the marine environment, have either entered into force or been revised to deal with the ever growing concern over the health of the Oceans.

Three new Conventions relating to shipping and the marine environment have come into force, along with the introduction of a new annex to the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto (MARPOL 73/78) and several amendments to existing annexes. Furthermore revised guidelines for the identification and designation of PSSAs were adopted in 2005. The most pertinent changes and amendments are detailed below.

1.1.1. Resolution A.982 (24) Revised guidelines for designation of Particularly Sensitive Sea Areas

The Wadden Sea was designated as a Particularly Sensitive Sea Area (PSSA) in October 2002, under IMO Resolution A.927 (22). In 2005 the guidelines for designation of PSSAs were revised, with the majority of the changes relating to the terminology within the guidelines, to make them more comprehensive. It can therefore be said that in doing so the International Maritime Organisation (IMO) had recognised "the need to clarify and, where appropriate strengthen certain aspects and procedures for the identification and subsequent designation of Particularly Sensitive Sea Areas and the adoption of associated protective measures" (Resolution A.982 (24) p2).

One change within Resolution A.982 (24) is the *implied* requirement that at the time of designation of a PSSA, an associated protective measure (APM) that addresses the identified vulnerability should be included (Resolution A.982 (24) para 1.2). However under the new Resolution no changes were made that relate to existing PSSAs, only to future applications. Therefore no changes are required with regard to the Wadden Sea PSSA.

1.1.2 MARPOL 73/78

MARPOL 73/78 is the main international Convention concerning the prevention of pollution from ships into the marine environment, throughout the years this has undergone several amendments. The Convention includes six Annexes which cover all aspects of pollution (Oil, Noxious Liquid Substances, Harmful Substances Carried by Sea in Package Form, Sewage, Garbage, and Air Pollution). Since 2002 a number of amendments and revisions have been made to the Convention including the adoption of Annex VI Regulations on Prevention of Air Pollution from Ships.

1.1.2.1 *Annex I – Regulations for Prevention of Pollution by Oil*

In 2001 the revised Regulation 13G from Annex I on oil pollution brought forward the phasing out of single hulled tankers[1] after pressure from the European Union over the sinking of Erika, this

[1] Existing Crude oil tankers 20,000+dwt and Product tankers 30,000+ dwt

was subsequently amended in 2003 and entered into force in 2005. Under the revised Regulations the scrapping of Category 1 tankers (Pre-MARPOL) was brought forward to 2005 from 2007, and Category 2 and 3 tankers[2] are to be brought forward to 2010. Furthermore Port States can deny entry to ports and offshore terminals to single hull tankers which are allowed to operate until their 25th anniversary[3], however they must inform the IMO of their intention to do so (Annex I, 2001 amendments para 8b).

In 2004, further revisions included two new Regulations which entered into force in January 2007. Regulation 22 states that ships constructed on or after 1st January 2007 which are 5,000 deadweight tonnes or above shall have a pump-room with a double bottom. Regulation 23 relating to accidental oil outflow performance, stipulates that all vessels delivered on or after 1st January 2010 must be constructed in such a way as to provide adequate protection against oil pollution in the instances of collision or stranding.

These revisions should all be seen as having a positive effect on the Wadden Sea PSSA, as when fully implemented, no tanker transiting the area will have a single hull, thereby reducing the risk of oil entering the environment as a result of collision or grounding. Additionally all new tankers will be required to meet stricter construction standards.

1.1.2.2 *Annex IV – Prevention of Pollution by Sewage from ships (In force 2003)*

In 2003 MARPOL Annex IV prevention of pollution from sewage from ships entered into force. In 2004 the Annex was revised making the regulations more stringent. The Annex will now apply to all new ships of 400+ gross tons involved in international voyages; existing ships will have 5 years from date of entry into force to comply. Additionally under the revised Annex ships will need to be equipped with one of three sewage treatment systems; a sewage treatment plant; a sewage comminuting and disinfecting system; or a sewage holding tank as the discharge of untreated sewage into the sea will be prohibited within 12nm (territorial sea) of any member State.

The enforcement of Annex IV will mean that no untreated sewage will be released into the marine environment within the territorial seas of the Wadden Sea States and therefore should reduce the level of nutrients entering the system from the shipping vector.

1.1.2.3 *Annex VI - Prevention of Air Pollution by ships (In force 2005)*

In 1997 the MARPOL Protocol 1997 Annex VI regulations for the prevention of air pollution from ships was adopted, however it was not until May 2005 that it entered into force. This Annex set rules for the levels of oxides of sulphur (SOx) and nitrogen (NOx) that can be released from ships exhausts with a global cap on the sulphur content of fuel of 4.5% m/m. The Annex also identifies Sulphur Emission Control Areas (SECAs) including the North Sea, English Channel and surrounding coastal and the Baltic Sea, where sulphur content of fuel must not exceed 1.5% m/m, or vessels

[2] Category 1, 2 & 3 tankers are identified by the year they were delivered and entered into service

[3] Tankers older than 20 years may not enter Wilhelmshaven. (ConocoPhillips, 2007a)

must be fitted with an exhaust gas cleaning system or other suitable technology to limit SOx emissions.

In 2008 further amendments were added to this Annex which are due to come into force between 2012 and 2020, these reduce the level of SOx emissions further. SOx emissions from ship exhausts will be further reduced from 4.50% to 3.50% by 2012, progressively being reduced to 0.50% by 2020. A feasibility review of this limit will be completed by 2018 at the latest. Limits for emissions within SECAs will be reduced to 1.0% by 2010 and further reduced to 0.10% by January 2015.

NOx emissions for marine engines were also agreed with the most stringent reductions being placed on Tier III engines (those installed on ships constructed after 2016 operating in emission control areas).

The North Sea has been classified as a SECA under Annex VI and the area delimitated by the designation includes the Wadden Sea area. Therefore ships entering the Wadden Sea and its ports must now use reduced sulphur fuel, thus reducing the harmful emissions released in the area.

1.1.3 The London Convention Protocol 1996 (In force 2006)

In 1996 the London Convention Protocol was adopted bringing the London Dumping Convention (LDC) of 1972 up to date and in line with current issues. The purpose of the 1996 Protocol is similar to that of the LDC, which aimed to protect the marine environment from all sources of pollution. The Protocol entered into force in March 2006[4] ten years after it was adopted.

The 1996 Protocol is more restrictive than the LDC and applies the precautionary principle with regard to any waste or matter being introduced to the marine environment. Under the Protocol all dumping is prohibited unless explicitly permitted under the reverse list[5] which includes dredged material, fish wastes and inert, inorganic geological material. Furthermore the Protocol also bans incineration at sea[6] of industrial waste and sewage sludge, with the polluter pays principle also adopted; if a company/person is caught dumping any banned substances they will have to bear the cost.

In 2006 amendments were made to the Protocol which entered into force in February 2007 which allows for the storage of carbon dioxide under the seabed. This amendment has created a basis "in international environmental law to regulate carbon capture and storage (CCS) in sub-seabed geological formation" (IMO, 2002a).

[4] Denmark and Germany are Parties to the Protocol. Netherlands party to LDC

[5] This is a list of acceptable items which can be dumped at sea under the 1996 Protocol (IMO, n.d.)

[6] Banned under Article 5 of the 1996 Protocol (IMO, 2002a).

1.1.4 The Protocol on preparedness, response and co-operation to pollution incidents by hazardous and noxious substances 2000 (OPRC-HNS Protocol) (In force 2007)

In June 2007 the Protocol on preparedness, response and co-operation to pollution incidents by hazardous and noxious substances 2000 (OPRC-HNS Protocol) entered into force. In order to combat major incidents or threats of marine pollution this Protocol aims to establish a global framework for international co-operation, as part of this any State party to the HNS Protocol will be required to establish measure for managing pollution incidents. Furthermore, ships must carry onboard a pollution emergency plan which specifically deals with hazardous and noxious substances in case of an incident.

1.1.5 The International Convention on the Control of Harmful Anti-Fouling Systems on Ships (AFS) (In force 2008)

In 2001 before the designation of the Wadden Sea PSSA the International Convention on the Control of Harmful Anti-Fouling Systems on Ships (AFS) was adopted, under this the use of harmful organotin in anti-fouling paint was prohibited. This Convention entered into force in 2008. Studies had previously shown that compounds such as tributyltin (TBT) have a range of sub-lethal effects on a range of species within the shellfish population. The AFS Convention will stop the leaching of these substances from vessels involved in international shipping thus reduce the levels of TBT in the water column and prevent any further deposition within sediments.

1.1.6 The Nairobi Convention on Removal of Wrecks (Adopted 2007, not yet in force)

This Convention “will provide the legal basis for States to remove, or have removed, shipwrecks that may have the potential to affect adversely the safety of lives, goods and property at sea, as well as the marine environment” (IMO, 2002b). It will do so by setting international rules for “prompt and effective removal of wrecks located beyond the territorial sea” (IMO, 2002b). Under this Convention the owner will be liable for the financial cost of finding, marking and removal of the wreck.

1.1.7 The International Convention for the Control and Management of Ships Ballast Water and Sediments (Adopted 2004, not yet in force)

This Convention contains technical standards and “requirements in the Regulations for the control and management of ships' ballast water and sediments” (IMO, 2002c). Ballast water is a necessary stability requirement for most ships. When taken onboard the water may contain species which, without treatment, can survive the ships transit and then be released in a foreign environment, where they may flourish. When in force this Convention will, “prevent, reduce and ultimately eradicate the transfer of harmful aquatic organisms and pathogens in the ballast water” (IMO, 2002c). Once in force this convention will require all ballast water to be treated.

Article 5 of the Convention addresses the need for all ports where ballast tanks are cleaned or repaired to provide Sediment Reception Facilities. The Convention also requires that ships should be surveyed/inspected by Port State Control to ensure that the ship has a valid certificate and Ballast Water Record Book.

1.1.8 The Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships (Adopted 2009, not yet in force)

The Convention is aimed at ensuring that ships, when being recycled after reaching the end of their operational lives, do not pose any unnecessary risk to human health and safety or to the environment. (IMO, 2002d).

In the past there have been issues with conditions at ship recycling locations, under this Convention these will be addressed. Ships being recycled will have to have an inventory of all hazardous materials, which will be checked via surveys throughout the ships lifetime and prior to recycling. Furthermore, the ship recycling yard will have to produce a 'Ship Recycling Plan' for each ship which will detail how exactly the ship will be disposed of.

1.2 EU Policy

Changes in EU Shipping Policy since the designation of the Wadden Sea include: the Third Maritime Safety Package which was adopted in April 2009, Regulation (EC) No 782/2003 on the prohibition of organotin compounds on ships and Directive 2005/35/EC on ship-source pollution and the introduction of penalties for infringements.

1.2.1 The Third Maritime Safety Package

After the pressure caused by both the public and political outcry after 1999 Erika accident, in which 20,000 tonnes of heavy fuel oil was washed onto the French coastline, the European Commission was forced to take action to improve maritime safety. The Commission proposed three new safety packages known as Erika I, Erika II and the Third Maritime Safety Package. The majority of the Directives under both the Erika I and Erika II packages were implemented prior to the designation of the Wadden Sea PSSA in 2002. The Third Maritime Safety Package was adopted in April 2009 and therefore still needs to be established. This package proposes seven measures, which are detailed below:

1.2.1.1 *Directive 2009/16/EC The role of Port State Control*

This Directive calls for further measures to improve Port State Control, in order to ensure that the condition of ships entering and leaving EU ports pose a low risk with regard to both the safety of the crew and the environment, thereby reducing the risk of an incident.

1.2.1.2 *Directive 2009/21/EC Compliance with Flag State requirements*

The purpose of this Directive is to ensure that EU flags are all of good standing with none being black or grey listed under the Paris Memorandum of Understanding. Furthermore, the IMO voluntary flag State audit scheme will be integrated into EU law making it compulsory for all EU flagged ships to comply with auditing requirements. At present EU flags vary in quality with some appearing on the black list, therefore this Directive aims to increase and standardise the level of quality amongst all EU flags.

1.2.1.3 *Directive 2009/15/EC Common rules and standards for ship inspection and survey organisations and for the relevant activities of maritime administrations.*

This Directive has been developed in order to make the procedure for inspection of Classification Societies more thorough and to authorise the Commission to perform audits and impose penalties if they do not meet a certain standard. Furthermore, this Directive aims to "give legal

certainty to stakeholders" (European Commission, 2009b). This has been reinforced by Regulation (EC) No 391/2009 on common rules and standards for ship inspection and survey organisations.

1.2.1.4 *Directive 2009/17/EC (amending Directive 2002/59/EC) Establishment of a community vessel traffic monitoring and information system.*

This Directive aims at improving both the collection of data and the transfer of data between EU countries by establishing a network specifically for this purpose. The concept of places of refuge and the decision making process has also been improved. The Directive also states that AIS will be fitted to fishing vessels over 15m in length, which should improve safety and reduce the risk of collision between commercial shipping and fishing vessels.

1.2.1.5 *Directive 2009/18/EC Fundamental principles governing the investigation accident in the maritime transport sector and amending council Directive 1999/35/EC and directive 2002/59/EC of the European Parliament and of the council.*

This Directive aims to provide comprehensive guidelines for all EU States regarding technical investigations. The maritime accident investigation Directive will be similar to that of the civil aviation industry as they will not seek to establish or apportion blame, but to provide information in order for lessons to be learnt and to help prevent future incidents.

1.2.1.6 *Regulation (EC) No 392/2009 Liability of carriers of passengers by sea in the event of accidents - Liability of Carriers (Athens Convention)*

The purpose of this Regulation is to establish a set of rules with respect to compensation for passengers onboard cruise ships or ferries in the event of an accident. This set of rules must be current and standardised and will be comparable to those for road, rail and international travel.

1.2.1.7 *Insurance Directive 2009/20/EC Insurance of ship-owners for maritime claims*

At present "there is no general obligation to be insured under international law"; this new Directive will require all EU flagged ships and any non-flagged EU ships which use European ports "to be insured against damage to third parties caused by their ships" (European Commission, 2009d). The aim being to reduce the number of sub-standard ships, as they will be unable to get insurance due to high risk they would pose to insurance companies.

1.2.2 Regulation (EC) No 782/2003 on the prohibition of organotin compounds on ships

In 2003 the European Parliament passed Regulation (EC) No 782/2003 on the prohibition of the use of organotin compounds on ships. These organotin compounds are most commonly found in the anti-fouling paints that are used on the hulls of ships, the most commonly known being Tributyl tin (TBT). Over the years various studies have concluded that these compounds are highly toxic to marine species particularly filter feeders e.g. molluscs. The Regulation applies to any ship flagged under a Member States flag or any ship which is operating under the authority of a Member State but not flagged under them and also any ship that is not falling within the previous, but which is entering an EU port (Europa, 2006). This Regulation aligns with the requirements of the IMO Anti Fouling Convention.

1.2.3 Directive 2005/35/EC on ship-source pollution and introduction of penalties for infringements.

In 2005 the European Parliament established Directive 2005/35/EC on ship-source pollution and on the introduction of penalties for infringements; this states that overboard discharge of any noxious substance is an offence which is punishable. This Directive applies to any ship navigating in European waters. Under the Directive it is an offence to discharge noxious substances in the following areas:

- Internal waters, including ports, of a Member State;
- Territorial waters of a Member State;
- Straits used for international navigation subject to the regime of transit passage, as laid down in the 1982 United Nations Convention on the Law of the Sea (UNCLOS Articles 37 - 39)
- Exclusive Economic Zone (EEZ) of a Member State;
- High Seas.

(Europa, 2009)

1.2.4 Integrated Maritime Policy

In 2007 the EU Commission presented its vision for an Integrated Maritime Policy for Member States, two years on they have made progress with several projects under way. “In its strategic objectives for 2005-2009 the Commission declared the particular need for an all-embracing maritime policy aimed at developing a thriving maritime economy, in an environmentally sustainable manner. Such a policy should be supported by excellence in marine scientific research, technology and innovation” (Van Houdt, 2008).

The Integrated Maritime Policy “will encompass all aspects of the oceans and seas in a holistic, integrated approach,” where the Commission “will no longer look only at compartmentalised maritime activities, but... will tackle all economic and sustainable development aspects of the oceans and seas, including the marine environment, in an overarching fashion” (Commission of the European Communities, 2007, p4). There is a further aim to “develop policies and legislative proposals that are coherent and mutually compatible” (Commission of the European Communities, 2007, p6), which would bring all Member States in line with one another. The establishment of united policies and inter-linking between industry (economic) and environment will strengthen the sustainability of Europe’s maritime sector.

The European Commission have also established a European Maritime Day, which will inform and update stakeholders of progress that has been made amongst the maritime community, the first of these annual events to be held in 2010.

1.2.5 Marine Spatial Planning

The Commission adopted the Roadmap for Maritime Spatial Planning: Achieving common principles in the EU in 2008, “Maritime Spatial Planning (MSP) is a key instrument for the Integrated Maritime Policy” (Commission of the European Communities, 2008, p2). Current marine spatial planning practices within the EU, as well as key principles and underlying issues are discussed within the document. Marine spatial planning has come to the forefront over the past few years and will become even more vital in the future due to the increasing competition between industries for use of the sea. This is especially true in European waters with the

development of offshore wind parks and increasing activity in the shipping industry. MSP is designed to "help(s) public authorities and stakeholders to coordinate their action and optimises the use of marine space to benefit economic development and the marine environment" (Commission of the European Communities, 2008, p2). Additionally, MSP creates a framework for evaluating and assessing human activities in order to manage any impact that they have on the marine environment. This may seem simplistic but the oceans/seas are complex ecosystems which cross over States boarders, therefore to address this appropriately action should be taken at a higher level. MSP will provide a discussion platform for Member States to "develop a holistic approach to the management of maritime activities in line with ecosystem requirements" (Commission of the European Communities, 2008, p3), resulting in the same approach being used by neighbouring countries instead of two different systems for the same piece of water.

1.3 Current Ship Security Measures in the Wadden Sea

1.3.1 Automatic Identification System (AIS)

Since the Wadden Sea PSSA designation in 2002 the most significant addition to ship security, surveillance, navigation and identification has been the requirement for all vessels of 300 gross tons and above engaged on International voyages, all vessels of 500 gross tons and above not engaged on international voyages and all passengers vessels irrespective of size to be fitted with an Automatic Identification Systems (AIS)[7]. This system transmits data including: ships identity, type, course, speed, navigational status and other safety related information, automatically to ships, aircraft and shore based facilities.

1.3.2 Traffic Separation Schemes (TSS)

Due to the high density of shipping activity in the southern North Sea the IMO has implemented traffic separation schemes in order to simplify the traffic flow and therefore reduce the risk of collisions. The main routes are:

- The Deep Water Route from North Hinder to the German Bight via the Frisian Junction.
- The Traffic Separation Scheme (TSS) from North Hinder to the German Bight via the Frisian Junction.
- The TSS from off Vlieland to the Terschelling German Bight which joins the Deep Water Route at the Jade Approach.

The Deep Water Route is mandatory for the following classes of ship:

- Tankers of 10,000 GT + carrying oils as defined under Annex I 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
- Ships of 10,000 GT + carrying liquefied gases in bulk.

[7] Regulation 19, SOLAS Chapter 5 became effective for all vessels in December 2004

(UKHO Admiralty Sailing Direction North Sea Pilot, 2007)

1.3.3 Vessels Traffic Services (VTS)

Denmark currently has no VTS arrangements in the North/Wadden Sea area.
The Netherlands has five systems which cover the North/Wadden Sea areas, these are shown below:

- Den Helder VTS- All vessels equipped with VHF are required to participate in the service and all vessels must report when entering or leaving the VTS area.
- Terschelling VTS - compulsory reporting for all vessels when entering or leaving the VTS area.
- Schiermonnikoog VTS – provides radar surveillance for the Terschelling -German Bight TSS
- Delfzijl VTS – is mandatory of all vessels entering or leaving the area.
- The Wadden Sea Central Reporting Station - is responsible for co-ordinating all relevant maritime authorities in event of an incident in the Wadden Sea area.

Germany provides extensive VTS coverage throughout the North/Wadden Sea area, with VTS surveillance in both the coastal areas and inner estuaries the most relevant are shown below:

- The Ems VTS
- The Elbe VTS
- The Jade VTS
- The Weser VTS

All of the above German VTS are mandatory for vessels carrying dangerous goods in bulk and whilst in the VTS area a permanent listening watch on VHF radio must be maintained. Sailing plans should be submitted for all vessels:

- Over 50m in length (over 40m for the Ems),
- Carrying dangerous cargo in bulk,
- Tankers which are in ballast, but have not been cleaned, degassed or completely inert after carrying petroleum or petroleum products with a flashpoint below 35°C
- Nuclear vessels.

The German Bight VTS is mandatory for all vessels entering the area, under this service a permanent listening watch on VHF radio is required. Sailing plans are also required for all vessels over 50m and all vessels carrying dangerous cargo in bulk.

(World VTS Guide, 2005)

1.3.4 Pilotage

In Denmark pilotage is compulsory for tankers over 60m in length when entering Esbjerg, also under the Danish Pilotage Act no. 567 of 09/06/2006 vessels carrying certain cargoes are obligated to be under pilotage:

- Carrying oil or have un-cleaned cargo tanks that have not been rendered safe with inert air.

- Are carrying chemicals/gases/highly radioactive material.
- Have more than 5,000t bunker oil onboard.

In the Netherlands harbour pilotage is compulsory for ships over 60m in length and for all vessels carrying oil, gas or chemicals. Also in the harbour of Harlingen pilotage is compulsory for all vessels. Additionally, for tankers required to use the deep water route a voluntary deep sea pilotage can be taken onboard.

In Germany compulsory pilotage is required for certain types of vessels on all of the main shipping routes and approach channels. For the Rivers Ems, Jade, Weser and Elbe the following vessels call for compulsory pilotage:

- Tankers carrying in bulk any of the following gas, chemicals, petroleum or petroleum products.
- Unloaded tankers which have not been cleaned, degassed or completely inerted after having carried petroleum or petroleum products with a flashpoint less than 35˚C.
- Other vessels that exceed 90m in length or breadth of 13m.
- Vessels with a draught of more than 8m require pilotage on the River Jade.
- Vessels with a draught of more than 6m require pilotage on the River Ems.
- Vessels which are bound for Bremerhaven on the River Weser require pilotage if draft is over 8m, if the vessel is going beyond Bremerhaven then pilotage is required if the draught is more than 6.50m.

For the German Bight compulsory pilotage is required for the following classes of vessels:

- Tankers which are > 150m in length or have a beam > 23m if not gas free or fully inerted when bound to/from the River Ems, Jade, Weser or Elbe
- Bulk carriers which are > 220m in length or have a beam > 23m when bound to/from the River Elbe.
- Bulk carriers which are > 250m in length and have a beam > 40m or more than 13.5m draught when bound to/from the Rivers Jade or Weser.
- All other vessels which are > 350m in length or have a beam > 45m when bound to/from the Rivers Jade, Weser and Elbe.

(UKHO Admiralty Sailing Direction North Sea Pilot, 2007)

Summary

Since 2002 the International and European communities have introduced several important pieces of legislation aimed at protecting the environment from shipping activities. These policies have and will continue to improve both the standard and safety of shipping, thereby reducing their potential negative impact on the marine environment. For the Wadden Sea, amendments to existing legislation and the introduction of new legislation should also improve the quality of the marine environment. Furthermore the development of the EU Integrated Maritime Policy will assist with bringing countries coastal policies in line with each other, thus encouraging and enabling them to develop further policies together specifically aimed at protecting vulnerable areas such as the Wadden Sea.

2.0 Expert Group

A group of nine experts with an interest in PSSAs and the issues associated with their designation and management of the marine environment were identified and invited to participant in the evaluation project. Seven of the nine experts approached agreed to participate and to provide their opinions and views on the major challenges that surround both the designations and effective management.

2.1 Questionnaire

A questionnaire was designed in order to collect qualitative data from the experts. Eight questions were developed in order for the experts to identify key issues and perceived areas of concern with PSSAs. Open questions were used so that the respondents could be as expansive as they wished; they were also encouraged to identify any literature that supported their views. A copy of the questionnaire is contained in Appendix A. The experts were given a time frame of 2 weeks to reply.

From the responses received, key ideas, concerns and recurring themes were identified; these are discussed in sections 2.1.1 to 2.1.5. Analysis of the responses identified that there were several areas where the experts held very similar views and these were therefore deemed to be of particular significance. The opinions of the experts and their responses were also utilised by the project team when designing the indicator suite used within this evaluation (Section 3).

2.1.1 Function of PSSAs as a protective mechanism

It was identified that many PSSAs were currently not fulfilling their true potential as a protective mechanism. It was suggested that the application of the concept itself is still unclear. For example, should a designation be applied to a wide geographical area which may contain several different ecosystems, each of which may have a specific vulnerability that needed addressing, or should it be applied to just the most outstanding areas? Alternatively should a PSSA be applied to any environmentally sensitive sea area that meets the criteria within the guidelines? In their opinion, this lack of clear definition leaves the concept open to abuse and therefore may reduce the value of an area being designated a PSSA.

Some of the experts were of the opinion that current PSSAs generally ignore the shipping sector as a whole as they are not represented well on nautical charts or promulgated to mariners effectively. This in turn leads to a lack of knowledge and understanding of the concept amongst the shipping industry and mariners themselves. Finally it was stated that PSSAs may be helping the conservation of designated areas but the majority of the designated PSSAs are located in developed countries and therefore are not fulfilling their function in an equitable manner.

2.1.2 Appropriateness of existing designations

Since 1990, when the Great Barrier Reef was designated as the first PSSA, there have been eleven new PSSAs and one extension to an existing PSSA. Not all of the designations are seen as appropriate, one reason being that when taking into account the IMO's definition of a PSSA, specifically "where such attributes may be vulnerable to damage by international shipping activities" Resolution A.982(24) some areas do not meet this criteria. For example the Galapagos PSSA is located in an area which clearly fulfils most criteria, but does not however appear to be under threat from international shipping, as major shipping lanes are located away from the area,

so the major threat comes from national traffic which can be legislated through other measures available.

Other designations are seen by the experts as inappropriate due to either the lack of or type of Associated Protective Measures[8] (APM) linked with the designation. Under Resolution A.982 (24) when States submit an application for a PSSA designation it "should contain a proposal for an associated protective measure" to help address the areas specific vulnerabilities. All of the experts questioned the appropriateness of certain APMs. The Western European, Wadden Sea and Baltic Sea PSSAs were those most commonly cited by the experts as having inappropriate APMs. With respect to the Wadden Sea it was noted that APMs were outside of the designated area and therefore the designation appeared to have no APM, the lack of delineation on hydrographic charts was also mentioned. Furthermore it was suggested that if a country included a protective mechanism which was in place prior to the designation as their APM, it was then unclear as to what exactly the purpose of the designation was.

The experts also commented that some of the designations are misdirected or their purpose unclear. An example of misdirection was the Western European PSSA which was submitted following a string of accidents involving major oil spills within the proposed area. This PSSA encompasses a vast area with several different types of ecosystems and includes World Heritage Sites and other protected areas. Due to the extent of the area actual vulnerability to shipping varies throughout, and, as such, a range of AMPs could have been incorporated. However, only one APM exists, this being mandatory reporting. At submission a second APM was proposed, which suggested a ban on single hulled tankers transiting the area. This was not an APM that currently existed within the remit of the IMO and was seen by some as the reason behind the designation, thereby questioning the appropriateness of such a designation.

Whilst this measure was disallowed it did however force the issue of phasing out of single hulled tankers by the IMO which has now been accelerated.

2.1.3 Legal and regulatory framework

The PSSA concept in itself is not legally binding as it is a Resolution and not a Convention, therefore only the APMs have a legal basis. If no APMs are included in the designation then the concept is not being used to the best of its potential. The APMs are legally binding as they exist under other IMO instruments such as MARPOL Special Areas or Ship Routing. However these are not the only measures that can be established. If the PSSA is located within the Territorial Sea the Coastal State may exercise their own rights under United Nations Convention on the Law of the Sea (UNCLOS) and therefore can implement measures under national law. An example of this was

[8] *Associated Protective Measure are* actions that have been approved or adopted or by the IMO. These include: Designation of MARPOL Special Areas (Annex I, II, V), designation of SECAs (Annex VI), Ships routeing and reporting, Areas to be avoided, or any other measure that has a legal basis and falls within the remit of the IMO

given as measures adopted by the Florida Keys PSSA, which included designation of 'no anchoring zones' through US National law.

It was also suggested that there should be a mandatory requirement for evaluation and reporting of shipping incidents and accidents within and adjacent to PSSA boundaries. In so doing it would help to demonstrate the effectiveness of the designation as a protective mechanism and would also highlight any new vulnerability that may arise and needed addressing. In conjunction with this it was put forward that monitoring of designations should be a continuous and ongoing process to ensure that they meet or are adapted to meet the changing nature of vessel characteristics within and adjacent to the area.

2.1.4 Stakeholder awareness

Stakeholders should include every group who are associated with the marine environment including non-profit groups such as non governmental organisations (NGOs), governmental bodies such as conservation and tourism offices, fishery agencies, and national protection agencies. Furthermore mariners and those who depend on the marine environment for their livelihoods such as fishermen, tour guides and pilots should also be included as stakeholders. Currently the level of communication amongst mariners and stakeholders is seen to be insufficient. It was stated that 'fishermen, tourism industry and seafarers must be better informed of purpose in order to understand benefits and how to follow Regulations'. It was also suggested that promulgation to mariners and identification of PSSAs on nautical charts must be brought inline and made consistent, in order to increase awareness across the sector. Comment was also made with respect to the shipping sector, who should be better informed about PSSAs and the fact that whilst they do help to protect the environment they also have socio economic benefits with respect to the fishing and tourism industries.

2.1.5 How can you measure effectiveness of a PSSA?

The purpose of a PSSA is to protect a sensitive sea area that is vulnerable to international shipping so for this to be effective the measures established must eliminate or reduce the risk in order to protect the vulnerable area. There was a consensus that any effort to measure effectiveness needs to start before or at the time of designation. An evaluation of such an area is a complex situation and the monitoring of both environmental and shipping indicators should be established before designation or at the time of designation so that a baseline can be established. This baseline can then be utilised to give the level of risk and state of the environment before the designation allowing for a comparison to take place at a later date to establish the effectiveness of the PSSA. The baseline data could also be used to help inform and proscribe the most appropriate APM to address specific vulnerabilities.

In order to evaluate a PSSA the following questions should also be asked:

- What were the objectives of the designation – has the designation met these objectives?
- Was a management plan been identified and implemented to monitor the designation and has it benefited the area?
- Is there a clear linkage among the attributes of the area, the specific vulnerability and the APM?

All the experts stated that the development of the APMs was vital for an evaluation of a PSSA as it is these that provide protection. If there are no existing APMs a risk analysis should be conducted in order to identify the most appropriate APM. However, if APMs are already in place then regular monitoring should be undertaken to evaluate the effect that the APM is having on the identified vulnerability. This would establish whether APMs have decreased vulnerability and if not what additional measure can be put in place.

The level of the stakeholder's knowledge and understanding of the PSSA concept should be evaluated and if required additional effort should be made to increase the level of understanding and awareness.

The experts also stated that in their opinion environmental indicators and vessel traffic characteristics of the area must be regularly assessed in order to understand what if any changes have occurred and what these may be attributed to. To do this the following monitoring systems should be established:

- Periodic evaluations to compare environmental damage, or the risk posed by shipping, both before and after the PSSA designation.
- Vessel monitoring systems should be utilised to establish if there have been any notable changes in vessel traffic characteristics and number of incidents/accidents.

By monitoring both the marine environment and shipping and identifying common factors that can be used as indicators, over time, it should be possible to identify the effect of the PSSA and whether there has been a positive or negative change of state within the area.

Summary

From the responses of the experts to the questionnaire the general consensus was that existing PSSAs are generally not fulfilling their true potential as protective mechanisms. The main reasons for this were noted as a lack of true understanding of the concept of a PSSA, lack of appropriate management plans and poor communication of their function and purpose to key stakeholders. Some of the experts also put forward that current PSSAs are not implemented effectively, which is key to their success. Furthermore it was suggested that in order to ascertain whether a designation was effective it was necessary to evaluate the area prior to designation and to monitor the area regularly after designation; this should be done in conjunction with the development of an appropriate management plan.

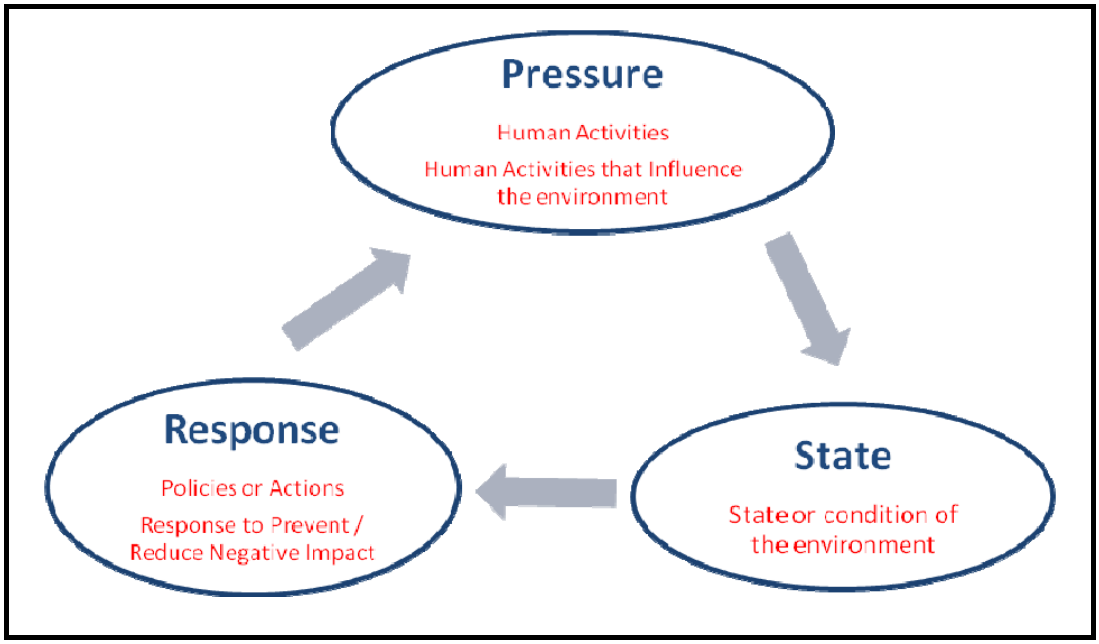
3.0 Development of an evaluative framework

In order to measure the effectiveness of the Wadden Sea PSSA it was necessary to develop an evaluative framework that could be utilised to identify and highlight key issues that are associated with the marine environment, shipping and PSSAs. This framework was developed from the views expressed by the expert focus group and the opinion of the project team. The results of this consultation were used to develop a general indicator suite of marine environmental pressures, measures and actions, which was then further refined by the Steering Committee to identify issues that were specific to the Wadden Sea. These choices were predicated upon definite links to shipping, and potential impact on marine environmental quality. The basis of the organisation of indicators was the idea of a Pressure-State-Response model, a concept used widely in environmental management.

3.1 Pressure, State, Response

A Pressure State Response (PSR) approach was used in order to establish the relevance of key indicators to the Wadden Sea PSSA. In its simplest terms a PSR framework works on the principle that human activities cause pressure on the environment, which in turn can change the state of the environment and in order to deal with these changes society responses to them. This response is mainly achieved through policies or actions to reduce the pressures and hence the environmental damage caused by them.

Figure 1 Pressure, State, Response



(adapted from Environment Australia 1996)

The key here is that indicators are not 'random' or 'convenient' measures of environmental quality. A clear rationale must be developed as to the selection of indicators, and links between pressure, state, and response should be articulated.

The indicators were put into one of the three areas pressure, state, response. The pressure indicators are based on maritime activities which may affect PSSAs. These included shipping volumes by type, shipping incidents, collisions low impact, collisions high impact, oil spills reported and *in situ* wind farms etc. It was argued that all of these indicators may cause pressure on the environment and lead to change in its state. The state indicators are based on the state of the environment, so they are environmental quality measures such as winter nitrate concentration, winter phosphate concentration, TBT concentration and non indigenous species by number, oiled birds, marine litter etc. The response indicators are the actions taken to respond to the change in state caused by the pressure. These indicators are APM development, communication to mariners, local agreements, co-ordination between States, oil spill response plans, and stakeholder education/awareness.

Each of the chosen indicators was then rated by the project team using a Likert scale, which uses declarative sentences, "followed by response options that indicate varying degrees of agreement with or endorsement of the statement" (DeVellis, 2003, p79). There were two general declarative statements used for this evaluation which were the strength of link to maritime activity and the potential risk to marine environment, each of the indicators were ranked between 1 and 5, with 5 being of high relevance and 1 being of low relevance. To be able to be more specific for the Wadden Sea PSSA a third declarative statement was added to the framework in which the indicators were ranked using the same method to see how relevant they are to the Wadden Sea PSSA.

The completed evaluation framework can be found in Appendix B. In order to rank the indicators intially the following two questions have to be asked and a value given:

1. How close is the direct link to Maritime activity?
2. How great is the potential impact to the marine environment?

These two rankings were then added together to give a value of indicators general relevance to the marine environment. All of the indicators were then ranked further by a third more specific question:

3. How relevant is this indicator when placed in the context of the Wadden Sea PSSA?

This ranking was then multiplied by the general relevance value to establish the relevance of that indicator to the Wadden Sea PSSA. Indicators with a score of 40 or above were seen as high relevance, moderate relevance was identified as having a score of 35-40, any indicator under a score of 34 was seen as low relevance.

In order to ensure that all appropriate indicators were included within the evaluative framework and the correct level of relevance to the Wadden Sea was attached; members of the project Steering Committee were invited to rank the indicators themselves using the same method as the project team detailed in section 3.1. They were also asked to suggest any additional indicators that they thought were relevant or missing from the indicator suite.

The results from the Steering Committee were very similar to those obtained by the project team with the majority of indicators being ranked similarly; although there was some disparity e.g. offshore developments and dredged spoil (see Annex B). Additional pressure indicators suggested for inclusions were: Oil spill by type and Loss of cargo/containers.

Once the evaluative framework had been established and ranked, the resultant list identified key areas which are the most relevant to the Wadden Sea PSSA. This list was finalised and agreed by the Steering Committee (Bremen, 20th August 2009). A further amendment to the indicators for state, was requested by the Steering Committee (Århus, 5th November 2009), which was the inclusion of marine litter and oiled birds. These had been discounted earlier as they had been ranked with a low relevance value (see 3.3.2.3 and 3.3.2.4).

These indicators also formed the basis for the start of more targeted spatial analysis using Geographical Information Systems (GIS) software. GIS output can be found in relevant sections.

An important point to note here is that the list contains rather fewer state indicators than were available to the project team through TMAP. On reflection this is not surprising. The TMAP represents a considerable body of data, some of which was started before the PSSA was in place. However, the PSR framework has allowed the team to establish a clear link between a range of indicators rather rely on data that, whilst important to establishing environmental quality, is of only slight interest to the evaluation of the PSSA. Secondly, the rationale of the PSSA itself is to minimise risk, thus it is not surprising that many of the indicators directly reflect this risk i.e. they deal with ships and their operation. Finally, a PSSA is often an open-boundary system. Therefore, trying to establish a direct relationship between environmental quality within a PSSA and shipping/industrial practice outside it is difficult. For example, whilst the nutrient levels within these waters are important in terms of establishing the eutrophic status of the area, it is impossible to distinguish a shipping 'signal' in relation to the considerable nutrient fluxes from local rivers and the North Sea. Thus, trying to conclude whether practice within, or due to the imposition of, the PSSA is improving its environmental quality is problematic.

3.2 Key indicators

The evaluative framework identified several key indicators with high (ranked above 45) or moderate (ranked above 35) relevance to the Wadden Sea PSSA. These can be seen in the table below:

Table 1. PSR Indicator Suite

Pressure Indicator	**State Indicator**	**Response Indicator**
Shipping volume by type	TBT	Development of APMs
Shipping incidents	Invasive species	Communication to mariners
Collision – low impact		Co-ordination between states
Collision – high impact		Oil spill response
Oil spills reported		Stakeholder awareness
Oil spills by type/volume/coverage		
Offshore development		
Dredging		

Once these key relevant areas had been noted the data received from the CWSS and other sources could then be re-examined to establish if the available data was sufficient or if any further data was required.

From the analysis of the data relating to these indicators it was recognised that much of the information required was either unavailable or problematic to use. For example, some organisations could not locate data, or obtaining it was difficult. In other cases data compatibility was questionable e.g. none of the three States use the same recording method for shipping incidents, and, finally, much of the data lacked sufficient specific detail. This included the lack of geo-referencing in terms of co-ordinates for monitoring sites and incident locations, the lack of any quantitative data for the size of a spill, and the use of non specific quantifiers such as 'trifle incident', 'heavy accident' and 'basic contact'. Whilst this presents a specific practical problem in regard of using such data in GIS analysis, it is also clearly impossible that such subjective statements from a range of parties are adequate when trying to establish clear policy.

3.3 Review of key indicators

3.3.1 Pressure

The key pressure indicators identified from the PSR framework are shipping volume type, shipping incidents, collision–low impact, collision–high impact, oil spills reported, oil spills by type/volume/coverage, offshore developments and dredging.

3.3.1.1 *Shipping Volume by Type*

Over 80% of merchandised trade by volume is carried by seaborne transport. 71% of world merchant fleet tonnage consists of tankers[9] and dry bulk carriers, whilst container ships represent just under 13% (UNCTAD, 2008). Since the Wadden Sea was designated as a PSSA the tonnage of the world merchant fleet has increased from 844.2 million tons to 1.12 billion tons. Figures from International Shipping Logistics (ISL) reports for the port of Hamburg over the same period show a growth of cargo tonnage from 98.3 million tons to 140.9 million tons with container throughput increasing from 4.69 million TEUs[10] (Cargo Systems, 2002) to 9.9million TEUS (ISL, 2008). Whilst all vessels can be a threat to the marine environment, certain vessels pose a higher risk due to the nature of the cargo they carry. Knowledge of the volume and type of shipping within or passing through an area is invaluable for the development of emergency response plans and for ensuring that appropriate oil spill response equipment is available as required by the OPRC-HNC Protocol.

Tankers carry many different categories of cargos which if released into the marine environment can cause extensive damage to both the environment and economy of the affected area. Whilst new legislation is in place with regard to construction of new tankers, there are still tankers in operation that do not meet these higher standards (1.1.2.1). Container ships are increasing both in size and number. These ships transport all types of cargo from consumer products to hazardous

[9] Crude oil, products and chemicals

[10] Twenty foot equivalent unit

materials. Over the past few years there have been an increasing number of incidents where container ships have grounded, additionally the number of containers being lost overboard is also on the increase. Lost containers pose a threat not only to the marine environment but also to shipping as they generally float just below the waterline and can easily cause hull ruptures should a vessel come into contact. At present there is no financially viable way of tracking the location of containers lost overboard.

3.3.1.2 *Shipping incidents and Collisions*

Shipping incidents can vary in size and the impact that they cause to the environment, for example a small sailing vessel which runs aground causes little if any harm to the surrounding environment, however an oil tanker which runs aground can cause extensive and devastating damage to the environment, flora and fauna as well as to the economy of the area. This damage can be felt and seen for several months or even years.

Due to the high level of international shipping, fishing, construction and offshore vessels operating within the area adjacent to the Wadden Sea, as well as a significant numbers of recreational boats, there is a probability of a collision of some sort. However the risk of a high impact and potentially devastating collision can be reduced to the lowest possible level practicable through controlling and monitoring vessel movements within an area. For this reason there is a need to clearly identify and differentiate between what is deemed to be a low or high impact collision and where they occur in order to identify 'hot spots' that may require additional measures to be implemented to reduce risk further.

3.3.1.3 *Oil Spills - Reported, Type, Volume/Coverage*

In 2008, 2.75 billion tons of tanker cargoes were shipped around the world, of which 483.4 million tons was unloaded in Europe (UNCTAD, 2009). There are several major oil terminals and refineries in North Europe; consequently there is a large volume of tanker traffic passing through the North Sea. Wilhelmshaven is a major oil terminal and refinery within the Wadden Sea, with an annual capacity of approximately 30 million tons (World Port Source), producing 260,000 barrels/day of refined products (ConocoPhillips, 2007b).

Aerial surveillance for identification and reporting of spills is undertaken by the Wadden Sea States in accordance with the Bonn Agreement. This ensures that a continuing and systematic surveillance is undertaken by member States. The current data from the Bonn Agreement shows the density of oil pollution in the North Sea and the location of spills, however due to the large area that requires monitoring there is a probability that some pollution incidents are not observed. The need to identify and assess oil spills is paramount to ensure that appropriate and rapid response can be undertaken and that those responsible for the spill can be indentified and prosecuted.

There are many different grades of oil which all have different viscosities and properties and the ability to identify both the type and size of any oil spill is vital to ensure appropriate action is taken. The Bonn Agreement Oil Appearance Code in conjunction with the use of satellite

imagery[11] are positive actions that can greatly assist with rapid identification and response. However it is of great importance to ensure that all incidents are accurately reported in order to assess the level of threat and whether additional action needs to be undertaken to reduce the risk further.

3.3.1.4 *Offshore Development*

The North Sea has been producing oil and gas since 1970s, with the majority of the platforms located on the continental shelves; therefore they pose limited risk to the Wadden Sea ecosystem. However there are also several fields located under the Wadden Sea which are used to produce gas, the Netherlands sector of the Wadden Sea currently has five fields under or partially under it. Under the Wadden Sea Plan "new exploitation installations for oil and gas will not be permitted" in the Conservation Area, despite this it also states that if "deposits can be exploited from outside the Conservation Area" then exploration activities are permitted within the area (Wadden Sea Plan, 1997 WSP § 4.1.10).

The Wadden Sea Conservation Area contains three offshore platforms (Mittelplate, Zuidwal and Laybucht) and the adjacent North Sea has several offshore energy platforms. At present they are mainly oil and gas platforms; however there are a growing number of wind parks. The oil and gas platforms are located away from the main shipping lanes should not pose a high risk with respect to vessel traffic. However with the development of the offshore wind parks in the German Economic Exclusive Zone (EEZ), which includes the German Bight Traffic Separation Scheme (TSS), an increased amount of traffic will be seen crossing the Wadden Sea and the inner TSS during the construction phases of these projects. This may increase the risk of collisions as supply and construction vessels will have to cross the TSS. Generally, offshore installations do not pose that higher risk as there is an exclusion zone for ships around them, however there is evidence that collisions do happen.

3.3.1.5 *Dredging*

The main shipping channels of the Wadden Sea require continuous dredging to enable safe passage of vessels to and from the ports. The major concern lies with the spoil that is removed and where it is dumped. The material that is removed from these channels and harbours will contain contaminated material such as TBT within the sediment (see section 3.3.2.1). Whilst over time TBT will decompose, the half life within sediment can be measured in years. Therefore by dumping to a new location the contamination is spread. In the Wadden Sea the main dumping sites are located within the PSSA where currently there appears to be no evidence of negative impacts. However with the expansion of the Jade-Weser port and the extensive dredging that will be needed, in addition to planned projects for Eemshaven and Hamburg harbour (WSF, 2008), this requires careful monitoring.

3.3.2 State

The key state indicators of the PSR were TBT and invasive species; in addition the Steering Committee of the project also felt that marine litter and oiled birds should also be included.

[11] Through EMSA and CleanSeaNet

3.3.2.1 *Tributyltin (TBT)*

TBT is an organotin compound which, since the 1960s, has been used in anti-fouling paints, which are applied to ship hulls and other marine installations, such as oil platforms to prohibit unwanted biological fouling. This is important as organisms attached to the hulls of ships produce added drag which slows the ship down resulting in more time at sea and more fuel used. The idea of biocide and anti-fouling systems is not new but had previously used chemicals such as DDT and arsenic, when TBT was introduced in anti-fouling paints it was regarded as less harmful than its predecessors. However, to be effective TBT had to be toxic to those organisms that attach to the ships hulls. But since then "TBT has been described as the most toxic substance ever deliberately introduced into the marine environment" (IMO, 2002e, p5).

Over time the TBT leaches from the paints into the water, here it can be broken down into less toxic chemicals by photolysis and biodegradation processes. However this decomposition process varies depending on environmental conditions. TBT has a high affinity for adsorbing onto sediment surfaces. So, if the area is heavily sedimented such as harbours and estuaries, the area could be contaminated for several years prolonging the risk to the environment and food chain. As buried, sediment bound, TBT has a greater half-life. Therefore, "it has been established that the main problem with TBT is its persistence in the marine environment" (IMO, 2002e, p6).

It has been found that TBT can disturb the hormone levels in molluscs, particularly dogwhelk (*Nucella lapillus*), which causes changes in sexual characteristics of the female molluscs (imposex), which will finally lead to a collapse of the viable population. This has been recorded in around 72 marine species. Furthermore studies have shown that traces of TBT have been found in marine mammals such as whales and dolphins as well as some fish species which shows that the TBT is being absorbed via the food chain. This is increasingly worrying as TBT is also toxic to humans. In 1989, Germany issued "a ban on the use of organotin compounds as anti-foulants for ships less than 25 metres in length" (Federal Environment Agency Umweltbundesamt n.d.).

3.3.2.2 *Invasive Species*

Previously the location of species was limited by geographical and oceanographic barriers. However, with development of international trade, alien species have been introduced into "new areas in which they were previously absent and to which they have been introduced by humans as mediator" (Nehring *et al*, 2009, p3). Over recent years there has been a notable increase in the number of reported cases of invasive species, many of which have had a disastrous effect on the area. This, it is thought, both represents an increase in the shipping vector, but also the gradual degradation of these bio-geographic boundaries through climate change. It has been proven that many of these species are transported in the ballast water of ships. Within the Wadden Sea 2009 Quality Status Report alien and invasive species are clearly defined and monitoring is in place.

The IMO has responded to the threat posed with the International Convention for the Control and Management of Ships' Ballast Water and Sediments, however this convention has not yet received sufficient signatories to enter into force.

3.3.2.3 *Marine Litter*

Marine litter is a global issue which causes serious damage as species can get entangled or ingest litter which can lead to death, it has also been well documented that it is a source of transport for

invasive species (Fleet *et al*, 2009, p2). Marine litter can enter the Wadden Sea and surrounding North Sea from both land-based and sea-based sources, these include indirect sources such as rivers, drains, sewage and storm water outflows or the wind. Land-based sources include tourism, recreational visitors, and unprotected waste disposal sites, whilst sea-based sources include shipping (commercial and recreational), fisheries, and offshore installations.

The North Sea is designated as a MARPOL Annex V 'Special Area' which restricts the disposal of garbage from ships in coastal waters. There is also a requirement for vessels to document within a Garbage Record Book all disposal and incineration operations, which can be used to account for how and where garbage is disposed of. There is a total ban on the disposal of plastics anywhere at sea.

In 2000 EC Directive 2000/59/EC on Port Reception Facilities for Ship-generated Waste and Cargo Residues was established. Under this Directive all member States must provide port collection facilities for waste; waste management plans are also required for all ports. Additionally under this Directive before ships can leave a Community port they are required to discharge their ship-generated waste unless they have an exemption, otherwise they can be detained. According to a study conducted in 2005 by EMSA this Directive has "raised awareness amongst ship operators, shipping agents, waste operators and environmental authorities of the environmental impact of illegal discharges into the sea" (OSPAR, 2009, p26). Furthermore, "the directive has led to an improvement of ship waste handling" (OSPAR, 2009, p26).

The 2009 QSR states that according to studies "shipping, the fisheries industry and offshore installations are the main source of litter found on German and Dutch beaches" however in the same section it also states that "identifying sources of marine litter is difficult as many types of items can come from multiple sources" (Fleet *et al*, 2009, p6). This view is further supported by an OSPAR report from 2009 which states that it is "difficult to confirm how much litter actually is attributable to shipping" this report goes further and suggests that "efforts should be made to improve our knowledge" (OSPAR, 2009, p26) of this area. So even though shipping is seen as a major contributor to marine litter, the methodology used to gauge provenance is not yet sensitive enough to establish its real contribution and therefore it cannot be determined as the only source.

3.3.2.4 *Oiled Birds*

Birds are the most visible victim of any oil pollution incident as they are seen to wash up along the effected coastline covered in oil. Oiled birds have been used in the Wadden Sea as a monitoring indicator for oil pollution for several years and are seen as a useful monitoring tool. Through this monitoring of oiled birds it has been recorded that "differences in oil rates between sea areas have clearly indicated that chronic oil pollution was more intense around shipping lanes than elsewhere" (Camphuysen *et al*, 2004, p115), furthermore there is also evidence that deliberate discharge from ships in terms of bilge waters containing fuel oils "are the main source of oil pollution" (Camphuysen *et al*, 2004, p116). However, "the number of dead oiled seabirds on the coastline is not in itself a reliable parameter for monitoring changes in oil pollution at sea" (Camphuysen *et al*, 2009 p2). Additionally despite the increased levels of oil pollution around the shipping lanes it has been stated that "there is little concrete information about the sources of oil pollution and other liphophilic in recent years" (Camphuysen *et al*, 2009, p4).

3.3.3 Response

The key response indicators from the PSR were the development of APMs, communication to mariners, co-ordination between States, oil spill response and stakeholder awareness.

3.3.3.1 *Development of APMs*

The development of APMs is an important part of the PSSA designation as the PSSA itself is not legally binding; it is the APMs which have a legal framework, being implemented through other existing Conventions such as MARPOL. Under the Resolution A.982 (24) APMs are used to address the vulnerability to international shipping, so if additional APMs are required as existing measures are inadequate then the APMs should be developed further.

The Wadden Sea and adjacent the North Sea was already subject to "…an extensive regime of protective measures prior to designation, consisting of both international and national regulations, aimed at reducing the impacts from and risks related to shipping. Examples of relevant measures are the MARPOL Special Areas against discharge of oil and garbage, routeing systems and making certain shipping routes compulsory for ships carrying hazardous goods and compulsory reporting for ships." (Wadden Sea PSSA, 2002, MEPC 48)

The German Bight TSS and the Deep Water Route, both of which are routeing measures to reduce risk from shipping, are located outside the boundaries of the PSSA which under the Guidelines is allowed. However this does mean that there are currently no APMs within the PSSA itself which raises issues of appropriateness. If no additional protection is required what is the purpose of the designation?

3.3.3.2 *Communication to Mariners*

Mariners are key stakeholders within the marine environment, they are also the stakeholders with the greatest ability to protect the environment; therefore it is essential that when establishing an environmental measure such as a PSSA they must be informed about the area that has been designated. This information should include the nature of why it is important to be extra vigilant and how it will affect them from an operational perspective. If mariners have no understanding, education or knowledge as to the locations and function of a PSSA, how are they expected to exercise additional caution when transiting the area?

3.3.3.3 *Co-ordination between States*

Co-ordination between States is particularly important for the Wadden Sea PSSA due to the trilateral nature of the designation. Where there are multiple interests and the potential for conflict there is a need for clear lines of communication and co-operation, in order to develop clear policies and goals that are equitable to all parties. Co-ordination and co-operation already exists between the States through a variety of instruments and agreements which provides a solid foundation for future work.

3.3.3.4 *Oil Spill Response*

In the event of an incident involving oil at sea the response method and co-ordination for any country is important as the faster and more efficient the initial response the less damage that should be caused in the long term. This is especially true for the Wadden Sea as the ecosystem of

mud flats does not fare well with oil, therefore having an efficient and well rehearsed response plan is essential.

The Wadden Sea countries have had bilateral agreements with each other for several years concerning emergency response actions in the event of an oil spill (DenGer and NethGer). A new agreement has been established called the DenGerNeth Plan, which will replace the already existing and operating bilateral response plans. DenGerNeth is a joint plan between Denmark, Germany and the Netherlands to deal with pollution in the event of an accident. This allows for each of the three States to ask for assistance if required also two quick response zones have been established in these areas action must be taken immediately so each State has the right to respond first even if the accident occurs outside their National Response Zone. However this agreement has yet to be ratified by the German and Dutch Governments. The Tri-lateral States are also all party to the Bonn Agreement carrying out both aerial surveillance and remote sensing to detect and combat pollution at sea.

3.3.3.5 *Stakeholder Awareness*

Stakeholder awareness is a key issue within the PSSA concept, as all the stakeholders need to understand and support the concept in order for it to be effective. Stakeholders are all those with a vested interest in the area and includes not only mariners and those whose livelihoods depend on the sea, but also others such as tourism agencies, national protection agencies and conservation NGOs. With respect to the Wadden Sea area where there are so many stakeholders and where due to its unique nature it has been classified as a World Heritage Site, it is imperative that all stakeholders are aware of the importance of preserving and conserving the area. The Wadden Sea PSSA currently excludes all of the major shipping lanes, and the vast majority of the designated area is between the mainland and fringing islands, which is not used by international traffic as it is too shallow.

3.4. Review of existing data

Data was reviewed from several sources including articles, books, the internet, Wadden Sea Quality Status Reports (QSR) and the World Heritage Site nomination report. The majority of environmental and ecological data was obtained from the Trilateral Monitoring and Assessment Programme (TMAP). Appendix C identifies indicators, source of data and availability of data.

3.4.1 Ecological and environmental data

The TMAP is a monitoring system for the Wadden Sea including the offshore area and islands; it contains both ecological and chemical parameters and is co-ordinated by the Trilateral Monitoring Assessment Group (TMAG). The TMAP covers the following areas:

- Birds (breeding birds, beached birds, breeding success, migratory birds)
- Habitats (beaches and dunes, salt marshes, seagrass)
- Marine species (mammals, macroalgae, macrozoobenthos, phytoplankton)
- Chemical parameters (bird eggs, fish, blue mussels and sediment)

These areas closely align with the reporting requirements of the following Directives and Conventions.

- Ramsar Convention
- World Heritage Convention (WHC)
- Convention on the Conservation of Migratory Species of Wild Animals (CMS/Bonn Convention)
- Agreement on Conservation of Seals in the Wadden Sea 1990
- OSPAR Convention (within JAMP[12])
- Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA)
- Birds Directive
- Habitats Directive
- The Water Framework Directive
- Marine Framework Strategy Directive (newly enacted)

Whilst data from TMAP was readily available, there were some areas of concern with regard to lack of coherence and consistency of data, as different methods were used by the three reporting States during data collection/monitoring. This is supported by two statements from the 2009 QSR, “the evaluation of present levels against background estimates is difficult because the three Wadden Sea countries use different estimates. Also different time windows and different statistics are used" (Van Beusekom *et al*, 2009, p. 14) and “recently, doubts arose whether the chlorophyll measurements by the different agencies and research institutes were comparable" (Van Beusekom *et al*, 2009, p. 7).

All stations where TMAP data are collected have a code; however specific co-ordinates are not readily available. Many of the monitoring sites are located away from shipping lanes between the fringing islands and mainland where international maritime traffic is not found. Therefore, some of the data was seen as not particularly appropriate to the area of study. Furthermore many of the ecological and environmental parameters of the available data were ranked as being of low relevance because the TMAP was not designed to monitor the impacts of shipping and therefore with respect to the indicator suite a clear and direct link to shipping could not be established. The TMAG produces a QSR every 5 years which aims to:

- Provide a scientific assessment of the status and development of the Wadden Sea ecosystem
- Assess the status of implementation of the trilateral targets of the Wadden Sea Plan

Some basic data for industry such as shipping and tourism is also compiled in the QSRs, with some data being extracted through the TMAP database. However because some of the data used within the QSRs are not part of the TMAP it was not owned and stored by the TMAP data units, which in turn raised difficulties with access to and ownership of data.

[12] Joint Assessment and Monitoring Programme

3.5 Pressure

3.5.1 Shipping data

Shipping data is not monitored or recorded through the TMAP and is currently collected by each individual country. However gaining access to shipping data for the project was problematical. One of the major issues in this respect was identification of those departments responsible for monitoring, collating and archiving of shipping data. Furthermore it was established that quality and quantity of the collected data was inconsistent and incomparable.

For this evaluation shipping data received from the Netherlands was in the form of the MARIN report from 2006, which only represented shipping incidents within that year, no further data was made available. Useable data for Germany was initially only available for the south western area, however after presenting the Executive Summary to the Steering Committee (Århus 5th November 2009), geo-referenced data for the northern section of German waters and the EEZ was made available. Prior to this data from Schleswig-Holstein had been unusable, as it contained no specific locations or co-ordinates; relying on location description i.e. 'Elbe' or 'North Sea/Coastal Sea'. Source of shipping data received is identified in Appendix D.

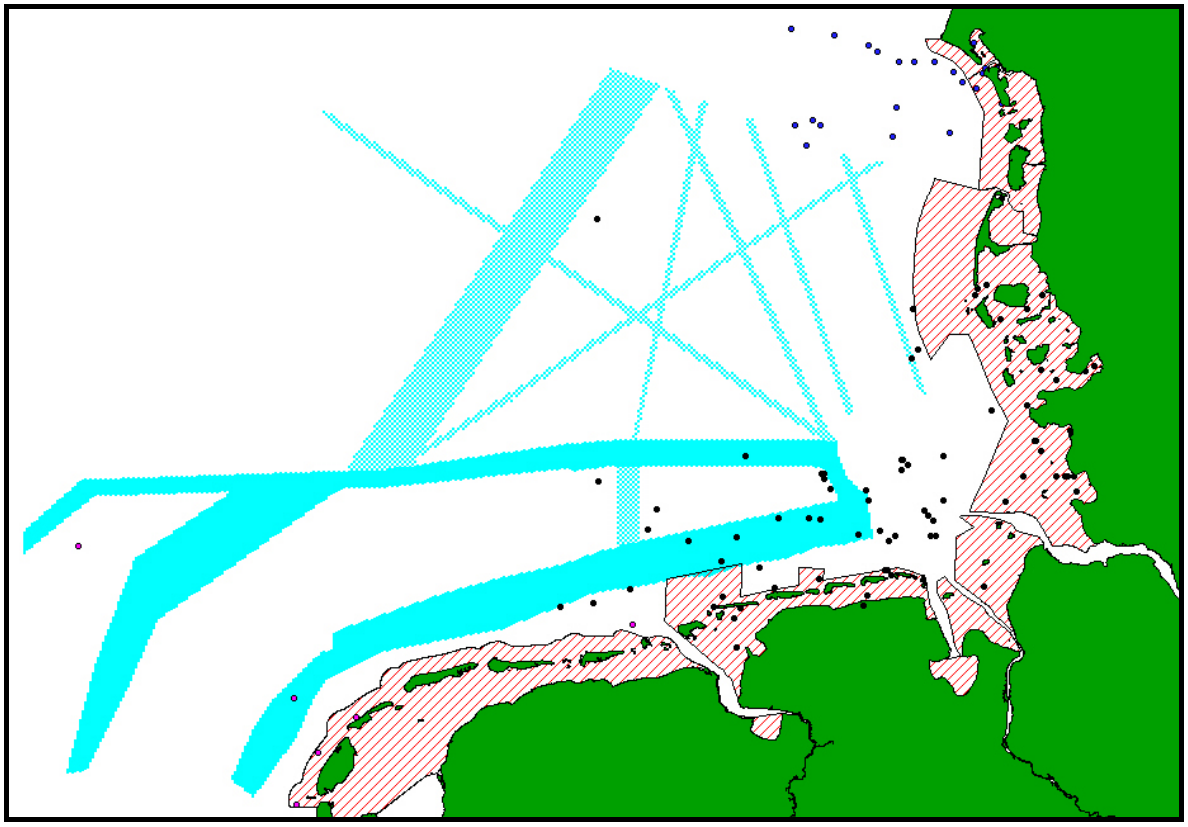
The shipping data received was also found to vary greatly, with each of the States recording different information. The data provided did not include a classification system attached to the description and generally used non-specific terms when describing the type of incident e.g. 'trifle accident' and 'less heavy accident at sea'. From which it was not possible to identify the extent or impact of an incident. This non-conformity for collection of shipping data was of concern, as shipping reporting requirements and monitoring responsibilities were identified as a potential burden with respect to the trilateral Wadden Sea area in the feasibility study undertaken by Southampton Institute in 2001. Furthermore the monitoring of shipping data was also on the agenda at the September meeting in 2006 of the WS Forum Shipping group, where it was put forward that a trilateral map of maritime traffic and density be undertaken for the Wadden Sea. From this the Secretariat offered at this time to 'take care for *(sic)* the information exchange of various documents.

Shipping data that was useable was inputted into the GIS model to show the locations of incidents, to identify any potential problem areas (Figure 2). As the data from the Netherlands only represented one year it was not possible to accurately identify any long term patterns within their area. From the German data received it can be seen that accidents are occurring both within the and around the traffic separation scheme. From the GIS model it can be seen that a major area of concern is located around the Jade Approach where the vessels enter or leave the TSS and pick up/drop off pilots.

Since the designation of the PSSA it is evident that accidents are still occurring both within the Wadden Sea area and the adjacent shipping lanes. However the data does indicate that there have been no major incidents since the Pallas in 1998. The majority of reported/recorded incidents in the Wadden Sea since 1990 have been low impact incidents with a number of small collisions. Despite this it cannot be said if these have resulted in any pollution, as this data is not available.

Data for types of vessels transiting and using ports within the Wadden Sea area was not readily available; however estimates could be made by utilising data available from ISL reports. From the incident data received from the countries only the Federal Water and Shipping Directorate North West identified the type of ship involved in the incident.

Figure 2. Location of incidents from available data



Key: Red hatched – PSSA boundary, Blue block colour– TSS and Deep Water Route, Blue dots-shipping routes, Dots – All Reported incidents from data received Danish Sector 2000-2008, Dutch Sector 2006, German Sector 2000-2008

3.5.2 Oil by type and volume

The data received from the countries shows that the availability of this type of data varies between the States. The data supplied shows that the type of oil spilt is not recorded by either the German or the Dutch, whereas the Danish data classified the type of oil reported, examples include 'light gasoline', 'mineral oil' and 'other types of oil'. The volume of oil spilt was not available for any State.

3.5.3 Offshore developments

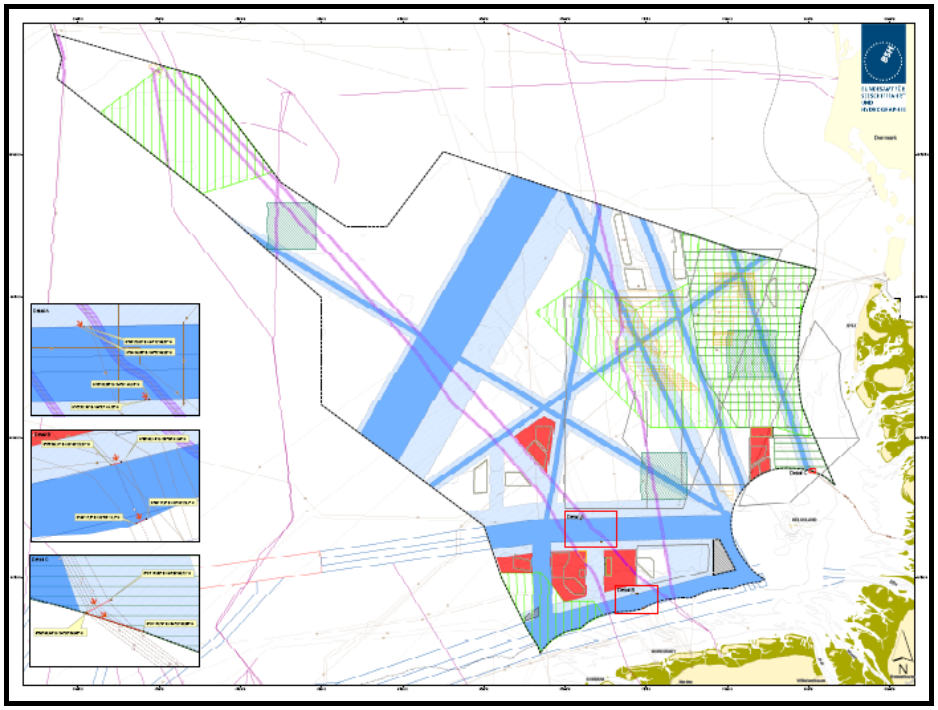
The North Sea has been well established with offshore platforms since the discovery of oil and gas reserves in the 1970s but with the current reserves starting to come to the end of their lifespan the North Sea fields and platforms will be decommissioned and removed. Furthermore, with the global decrease in oil reserves and the threat of climate change governments are looking for new renewable sources of energy. The Danish and Dutch sectors of territorial seas and respective EEZs already have established wind parks and the German Government are in the process of

establishing a vast programme of wind parks in both the North and Baltic Seas. In the German EEZ more than 40 wind farms are in the planning stage in both the North and Baltic seas, 33 of which have been approved and at least 21 of them are in the North Sea as the German government wants to be able to produce 20,000-25,000 MW of their energy through offshore wind farms by 2030 (Nehls and Witte, 2009b, p2). The risk of a ship colliding with wind turbines is relevantly low as there is an exclusion zone around them; also seafarers tend to avoid objects that will cause damage to the ships. However, from the shipping data from the Danish Admiralty it can be seen that accidents do occur between ships and wind turbines, so this must be monitored.

According to the Wadden Sea Plan the construction of wind farms is prohibited inside the Wadden Sea Conservations Area, however they are allowed outside the Conservation area if there is no negative impact on important ecological areas and in the adjacent North Sea. There is always a risk with offshore installations as an incident involving them and a ship could occur, the risk of an incident is always increased during construction phase as a greater number of supply vessels are transiting across the path of international traffic, this is especially true with the opening of the Jade-Weser container port.

The location of existing offshore wind parks and those that have been approved for development were obtained from the German Federal Agency for Shipping and Hydrography (BSH) Spatial Planning documents (BSH, 2009a, Appendix A). These locations are shown in Figure 3, from which it became evident that there is a potential area of high risk to shipping, where vessels entering and leaving the ports of Emden and Delfzilj cross the inner TSS following either a northerly or southern route.

Figure 3. Location of wind parks in the German EEZ – existing and planned



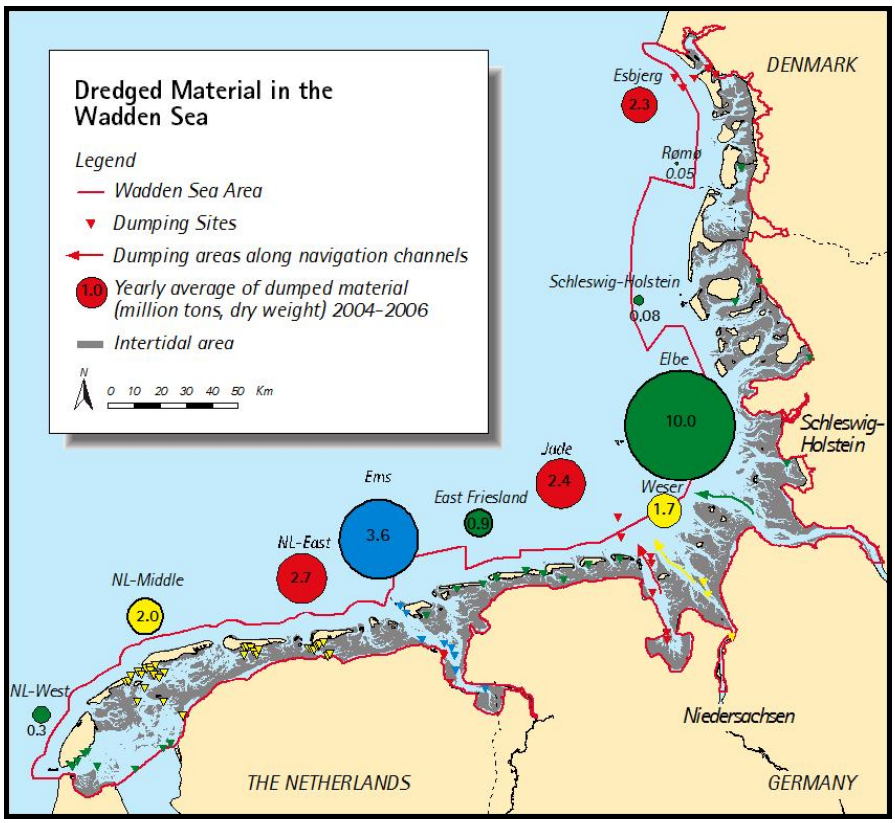
(BSH, 2009b)

Key: Red areas – priority areas for offshore wind energy, Blue areas – priority shipping routes, Light blue areas- reserved shipping area

3.5.4 Dredging

Dredged spoil removed from harbours and estuaries heavily used by shipping can be contaminated with TBT or contain cyst forms of invasive species which can be harmful to the marine environment. Where this spoil is dumped can have a have impact on the immediate environment. Figure 4 identifies the location of major dump sites within the Wadden Sea, which are located within the PSSA. From the data collected from monitoring sites around the Wadden Sea and despite the potential for harm from the spoil, currently no adverse affect have been identified. The majority of dredge spoil currently comes from the Elbe, but this is expected as it is presently one of the busiest navigation channels, with Hamburg seeing an estimated 40,000 ship movements in 2007 (Hamburg Port Authority, 2007, p16). The removal and dumping of dredged spoil may pose an increased risk to the Wadden Sea area during the construction of the Jade-Weser container port where a major capital dredge is required in order to deepen the approach channel to 18m. Data from the monitoring sites close to the Jade area indicates that the sediment in the area contains a higher level of TBT which has not yet broken down.

Figure 4. Map of dumping sites and yearly average amount of dumped dredged material in the Wadden Sea in the period 2004-2006.



Data source: OSPAR. (Nehls and Witte, 2009c, p7)

3.6 State

3.6.1 TBT

TBT has been monitored in the Wadden Sea area for several years from five different sites and according to the 2009 QSR the levels of TBT experienced a reduction of between 80 and 90% in all

areas. Geographically the highest levels of TBT in sediment occur in NL-West and Jade areas. This trend will probably continue especially at the Jade monitoring site due to the dredging of the channel for the new Jade-Weser container port which will disturb the sediment possibly causing TBT levels to rise (Bakker *et al*, 2009, p15).

3.6.2 Invasive Species

The Wadden Sea ecosystem has several non-native species but many of those seen as invasive have been introduced deliberately, this includes the Pacific Oyster which was introduced by aquaculture, the Pacific Oyster has now spread throughout the Wadden Sea. Another important invasive species is the *Spartina* grasses which were introduced in the early 20th Century to help protect the coast, however since then the *Spartina* grass has mutated and can no longer by controlled. Both of these examples have intentionally been introduced by humans and have not come from ships ballast water transfer. However, the American razor clam *Ensis directus* has been introduced by ballast water and is quickly invading the whole coast. Effects of invasive species have been seen on the native populations so should be monitored carefully.

This issue is of worldwide concern and currently an International Convention for the Control and Management of Ships' Ballast Water and Sediments is open for signatory at the IMO but has yet to enter into force. This convention will require ships to treat their ballast water prior to discharging directly to sea, however there are still issues with the availability of cost effective and efficient technology so many States have not yet ratified the convention[13].

3.6.3 Marine Litter

Marine litter is a persistent problem which affects the whole marine environment and poses a risk to several marine species which include seabirds and marine mammals. The OSPAR region has been monitoring levels of marine litter since 1998, therefore "a standardised protocol for collecting comparable measurements of beach litter within the OSPAR area" (OSPAR Draft QSR 2010, p29) has been agreed. Throughout the North Sea area the amount of marine litter varies considerably and from an OSPAR Commission project which monitors marine litter it has been established that "significantly more items were found on beaches in the northern regions (northern North Sea and the Celtic Seas) than on the beaches on the Iberian coast and in the Southern North Sea" (UNEP, 2009, p108) which includes the Wadden Sea. From surveys carried out on four beaches in the Wadden Sea area between 2002 and 2008 it has been found that on average per a 100 m there is 236 items of litter (Fleet *et al*, 2009, p4).

A study on the amount of plastic particles found in the stomachs of Fulmars has also been used to establish trends in floating litter at sea as they only feed offshore. From a monitoring programme in the Netherlands it has been found that there has been "a significant reduction in plastic abundance from 1997 to 2006, mainly through a reduction in raw industrial plastics" (OSPAR Draft QSR 2010 p30; also see 3.3.2.3).

[13] The countries have ratified the AFS

3.6.4 Oiled Birds

Oiled birds have been used for several years as a monitoring tool for oil pollution levels in the Wadden Sea, from these studies it has been shown that throughout the Wadden Sea and its approaches "that oil rates have declined significantly over the last decade" (Camphuysen *et al*, 2009, p10). This view is supported by data from the OSPAR Commission, in their draft 2010 QSR they stated that "observations of oiled guillemots suggest that oil pollution at sea has been decreasing" (p6). It has been established that the oiled bird rate is higher along the North Sea coastline of the Islands than on the landward side of them. Furthermore it has been stated by Camphuysen *et al*. in the 2009 QSR, Oil pollution and Seabirds report, that "the effect of the designation of the PSSA Wadden Sea in 2002 is unclear, for within the Wadden Sea, oil rates have always been lower than along the North Sea Coasts" (p10). The decline of oiled bird rates observed in the Wadden Sea area is mirrored across European waters.

3.7 Response

3.7.1 Development of APMs

At the time of designation of the Wadden Sea PSSA, no additional APMs were proposed as there were already several international and national measures in place, including a traffic separation scheme and a deep water route. These routeing measures are adjacent to the PSSA and do not fall within the present PSSA boundaries. It should be noted that a PSSA in itself is not a legally binding instrument; it is the APMs which have a legal basis and give the area the protection[14]. The approach channels to the ports in the area were also excluded from the original designation. From evaluation and analysis of existing data it is evident that the area between the Wadden Sea islands and the inner TSS is an area that is vulnerable to shipping and that even after the designation of the PSSA it experiences a higher level of shipping incidents and accidents than is desirable or acceptable for an ecologically and environmentally sensitive area (Figure 2).

The development of offshore installations to the north of the inner TSS (Figure 3) will place additional pressures with regard to navigation within the area, particularly in those areas where construction traffic has to cross the TSS. Additionally ships approaching and leaving the Ems River ports are required to cross the inner TSS and must pass between existing offshore installations (Dutch) and an installation in the construction phase (German); in addition a number of wind farms are planned for this area (3.5.3).

A substantial area of the PSSA, particularly to the south of the Elbe/Weser approaches is contained within fringing islands and is not navigable by international traffic. From data received it is evident that incidents do occur in these areas and additional protection could be afforded

[14] Resolution 982 (24) para 1.2 : At the time of designation of a PSSA, an associated protective measure, which meets the requirements of the appropriate *legal instrument* establishing such measure, must have been approved or adopted by IMO to prevent, reduce, or eliminate the threat or identified vulnerability.

through Coastal States and their rights as proscribed within United Nations Convention on the Law of the Sea (UNCLOS)[15].

3.7.2 Communication to Mariners

Promulgation of information pertaining to PSSAs is most commonly through Marine Guidance Notices, Pilot books, Sailing Directions and nautical charts (paper and electronic) of appropriate authorities. At present there is no requirement under STCW '95[16] for mariners to receive any formal environmental education.

A questionnaire was undertaken as part of the project (Appendix E). One of the main target groups was mariners. The results indicated that whilst many mariners had heard of the concept of PSSAs did not know what it is for, or how it is marked on nautical charts.

Currently the UK Hydrographic Office (UKHO) does not include the Wadden Sea PSSA on the main paper charts for the area 1408 and 1423, however it does appear on chart 3766 (approaches to Esbjerg). The BSH identifies the PSSA on its routing chart only. All Dutch and Danish charts have the PSSA delineated (pers comm. Huisman & Poulsen, August 2009). From communications with the UKHO it was found that they 'pick them up from the Foreign Government charts' and that 'each case of PSSA is looked at on an individual basis' (Pers comm. Gibbons, October 2009). This suggests that as the PSSA is not marked on the BSH paper charts it will not be placed on the UKHO charts as they use BSH charts for information. The PSSA is identified on electronic charts of the countries[17], however not all ships have access to electronic portfolios and there is still a requirement for paper charts to be carried.

Under section 9.1 of Resolution A.982(24) it is only the APMs which have to be marked onto a chart, as it stated that "when a PSSA receives final designation, all associated protective measures should be identified on charts in accordance with the symbols and methods of the International Hydrographic Organization (IHO)" (Resolution A.982(24), 2005, p13).

Furthermore from the questionnaire none of the mariners/professional seafarers identified the Wadden Sea as a PSSA which raises the issue of the level of communication regarding the designation of the PSSA to the shipping industry as a whole.

3.7.3 Co-ordination between States

This Tri-lateral designation is clearly working and the States involved are communicating well, this is demonstrated through the key trilateral policies which apply to the whole area as well as the

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[15] E.g. By entering foreign ports and other internal waters ships are within the territorial jurisdiction of the coastal State. Therefore pursuant of Article 211(3) coastal States may establish particular requirements for the prevention, reduction and control of pollution as a condition for the entry of foreign vessels to their ports

[16] International Convention on Standards of Training, Certification and Watch-keeping (1995 amendments)

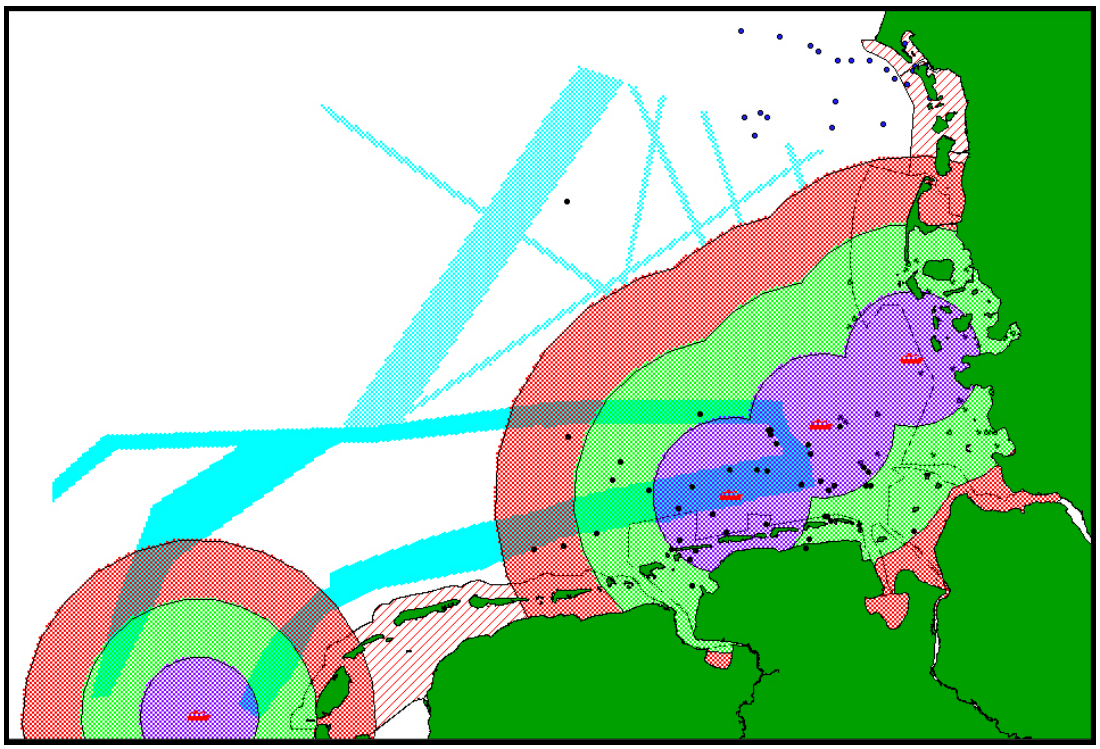
[17] However not on UKHO Ecdis (North Europe, Folio 5)

production of the Quality Status Report every four to five years. However, the current monitoring techniques vary between each State which makes data difficult to compare, so data collection methods should be brought into line with each other to produce a unified and coherent data sets (see 3.4.1). The three States are also a Contracting Party of the Bonn Agreement, which aims to reduce marine pollution in the North Sea, under this the parties have to work together to combat pollution issues. One way is in the use of aerial surveillance which is undertaken by every North Sea State.

3.7.4 Oil spill response

There are clear plans in place for dealing with emergency response to oil spills in the Wadden Sea Area. There are 3 ETVs located within German waters and 1 available in Dutch waters. Denmark does not have a dedicated ETV; however they do have arrangements in place for chartering a vessel in the case of emergencies. The location of these ETVs and distance circles to represent response times were applied to the GIS model. From this it was identified that there is a substantial area of the southern Wadden Sea that is not covered, even after a 3 hour response period, this area is located to the west of the German/Dutch border. It must be noted that not all of the ETVs are on station at their designated location at all times.

Figure 5. Location of ETVs indicating response time coverage of Wadden Sea area



Key: Purple circle – 1 hour response zone, Green circle –2 hour response zone, Red circle –3 hour response zone

3.7.5 Stakeholder awareness

A simple questionnaire was utilised to identify the level of awareness of PSSAs and their purpose amongst key stakeholders. This primary research was conducted by the project team with help from the three States. A copy of the questionnaire results can be found in Appendix E.

Amongst stakeholders it was clear that the level of awareness and knowledge is insufficient, particularly amongst professional seafarers and some local pilots operating in the Wadden Sea area. From the questionnaire it found that 71% of stakeholders had heard of a PSSA, but when asked further in-depth questions, it was evident that they had little knowledge of the function or purpose of a PSSA.

Literature written about the Wadden Sea PSSA has stated that "the PSSA Wadden Sea designation will send strong signals to the international shipping community and increase awareness of the particular sensitivity of the area to impacts from shipping, such as oil"(Camphuysen *et al*, 2004, p116). But this is clearly not the case, from the 88 stakeholders asked only 12% (7) of the stakeholders were well informed and knew that a PSSA is to 'protect an area which is vulnerable to international shipping and which is recognised for its environmental, or scientific or socio-economic importance'. Of these seven stakeholders only one of them was a professional seafarer. Also, when asked the location of designated PSSAs only stakeholders who lived in the Wadden Sea region identified it as a PSSA. Of the 32 Wadden Sea residents only 18 of them knew that it was a designated PSSA.

The Wadden Sea PSSA is currently not marked on either the UKHO or BSH (except for the routing chart) paper charts for this area. When the stakeholders were asked how a PSSA was marked on a nautical chart only four identified the symbol correctly, for most of the land based stakeholders this would not raise too much concern, but for the pilots, local fishing and professional seafarers this poses a great deal of concern.

4.0 Recommendations and future measures

The following recommendations are made after careful consideration of the findings of the evaluation of the Wadden Sea PSSA. It can be said from the results of the TMAP presented within the QSRs that the overall state of the marine environment of the Wadden Sea continues to be in a healthy state and also shows some areas of improvement. Additionally there are no reasons to suggest that this should change negatively in the future, particularly when consideration is made of new shipping and EU policy, all of which should be beneficial with respect to protection of the marine environment. Furthermore the introduction of new technology such as AIS and continuing improvements in surveillance and monitoring of shipping can only enhance the safe movement of vessels adjacent to the Wadden Sea PSSA. However it must be acknowledge that vessel numbers for international shipping transiting close to the PSSA have increased since its designation and will in all probability continue to do so in the future. As such, there is a great need to ensure that promulgation of the areas importance, which has been further enhanced through its nomination as a World Heritage Site, is a top priority. The present delimitation of the PSSA excludes areas transited by international shipping and it is these vessels that pose the highest potential risk to the Wadden Sea.

4.1 The current PSSA designated area should be extended to include the inner traffic separation scheme (TSS) and approach channels to the ports. (Figure 6)

4.1.1 At the time of designation of the Wadden Sea PSSA the APMs included a Mandatory Deep Water route and the inner TSS, both of which had already been established by the IMO. These APMs are adjacent to the PSSA and do not fall within the present PSSA boundaries. It should be noted that a PSSA in itself is not a legally binding instrument; it is the APMs which have a legal basis and give the area the protection. The approach channels to the ports in the area were also excluded from the original designation.

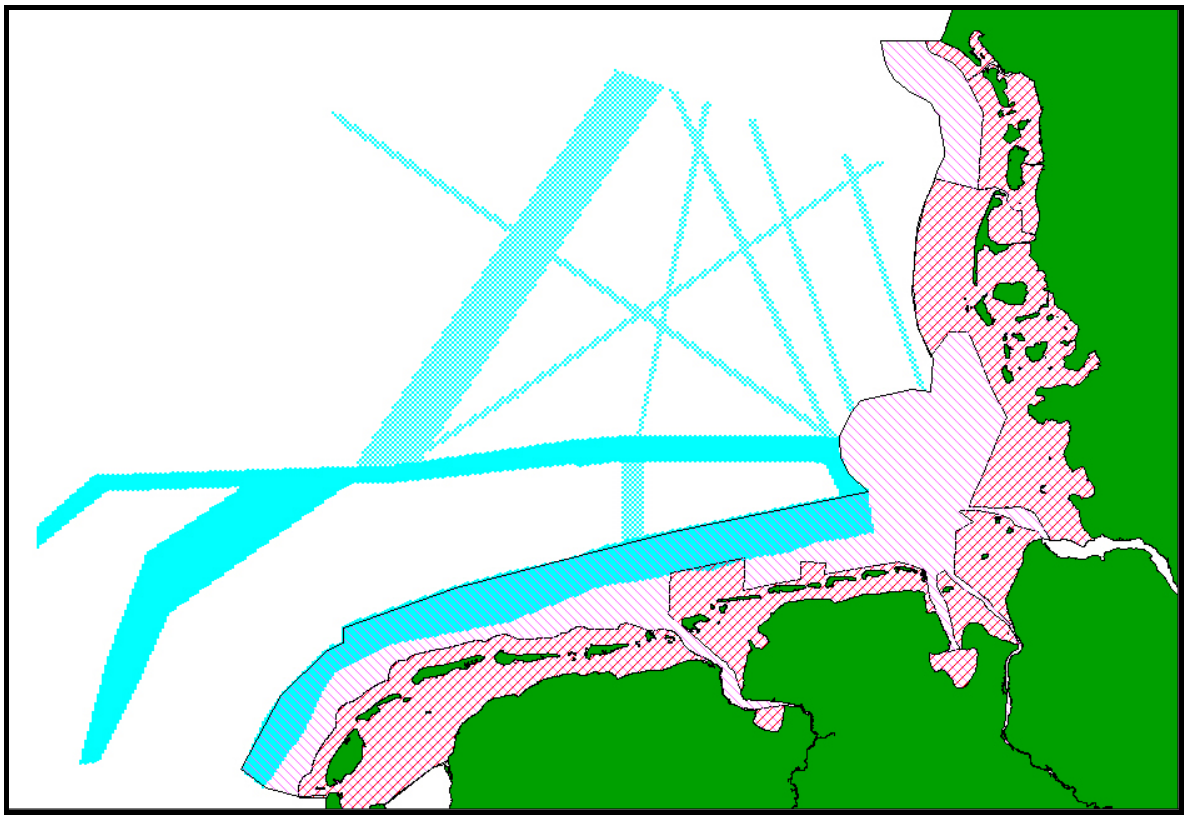
4.1.2 From evaluation and analysis of existing data it is evident that the area between the Wadden Sea islands and the inner TSS is an area that is vulnerable to shipping and that even after the designation of the PSSA it experiences a higher level of shipping incidents and accidents than is desirable or acceptable for an ecologically and environmentally sensitive area.

4.1.3 The development of offshore wind parks to the north of the inner TSS will place additional pressures with regard to navigation within the area, particularly in those areas where construction traffic has to cross the TSS. Additionally ships approaching and leaving the Ems River ports are required to cross the inner TSS and must pass between an existing offshore installation (Dutch) and an installation in the construction phase (German); a number of wind farms are also in the planning stage for this area.

4.1.4 TSS exist in many areas of high vessel traffic around the world in order to help prevent collisions and accidents. The majority of mariners will not associate a TSS as an APM to help protect an environmentally and ecologically vulnerable area i.e. a PSSA; rather as a routing measure that must be complied with. This is backed up by the findings of the stakeholder questionnaire where mariners' knowledge of PSSAs was limited. Therefore to try and enhance the level of protection that should be afforded by the inner TSS, it is suggested that the extension of

the boundary, with the associated delineation of the PSSA on nautical charts, would be beneficial, with respect to raising awareness of the areas vulnerability to mariners.

Figure 6. Extension of existing PSSA to include 12nm boundary, inner TSS and ports approaches



Key: Red cross hatched– The existing boundary of the PSSA, Pink hatched – Proposed Extension which includes the 12nm boundary, Inner TSS and port approaches, Blue blocked colour-TSS and Deep Water Route, Blue dots-Other shipping routes

4.1.5 There is also cause for concern with regards to the level of awareness and understanding of the function and purpose of the PSSA amongst stakeholders and professional mariners. The PSSA is not uniformly identified on all nautical charts, the reason for this is not totally clear, however the fact that large areas of the currently designated area are not navigable by international shipping would provide a logical explanation. However this does not help the integrity of the PSSA, which still requires consideration by vessels passing adjacent to the area. Results from a questionnaire demonstrated that professional mariners demonstrated a very poor or non existent knowledge of the existence of the Wadden Sea PSSA.

4.1.6 It is also important to take into account the volume of international shipping passing adjacent to the PSSA and to ports within the Wadden Sea area, which is increasing year on year. The opening of the new Jade-Weser container terminal will see a significant increase in larger and deeper drafted vessels through the area and approaches. Furthermore whilst there is mandatory pilotage for some vessels through the approach channels to the ports, there was evidence that some of the pilots operating within the area are unclear or unsure about the PSSA designation. This highlights the need to include the approaches within the designated area.

4.1.7 The recent successful nomination of the Wadden Sea as a World Heritage Site further highlights the need for any vulnerability from shipping to be addressed in order to offer the highest level of protection possible to the area.

4.2 There should be extended co-operation and collaboration between the CWSS, DenGerNeth and Bonn Agreement to enable a more comprehensive and cohesive management approach to be adopted.

4.2.1 Collaboration amongst coastal states is of the utmost importance with regard to developing a comprehensive and cohesive management framework. Since the establishment of the CWSS in 1987 there is evidence of good dialogue between all States, however there is a need to progress towards a more effective management strategy that encompasses practices similar to those undertaken by the Great Barrier Reef Marine Park Authority and within the Helcom Baltic Sea Action Plan with respect to the PSSA. The ability to work within a common framework enables a more proactive and cohesive approach to be undertaken. This strategy would help to avoid duplication of tasks and the possibility of misrepresentation or misinformation.

4.2.2 By extending co-operation and collaboration and working within a common framework, the opportunity will arise to develop and undertake a common risk analysis for the Wadden Sea PSSA in order to determine and instigate common response measures. (See also 4.3.3)

4.3 Collection, interpretation and sharing of environmental and ecological data within the Trilateral Monitoring and Assessment Programme (TMAP) should be brought into line to enable a more cohesive and effective monitoring programme. Data that directly pertains to shipping should be collected as part of the ongoing TMAP evaluation and reporting programme.

4.3.1 Whilst monitoring of the Wadden Sea has been undertaken for many years, the focus has been on ecological and environmental indicators. This type of monitoring whilst of great importance with respect to the PSSA fails to encompass several key elements, particularly with respect to shipping specific data. Additionally there are issues with respect to lack of continuity, quality and collaborative exchange of data that is currently collected.

4.3.2 Environmental and ecological data for the Wadden Sea area has been collected in some cases since the late 1960s. However a common methodology has not always been employed by the three Wadden Sea States and therefore data has had to be normalised in order to be included within TMAP and the QSR reports. It is recommended that the type, collection, interpretation and sharing of collected data are brought into line with a common baseline that will enable a more cohesive and effective monitoring programme to be established.

4.3.3 The current TMAP data collection model includes no shipping related parameters, as identified within the evaluation indicator suite (section 3.1). The inclusion of this data would enable a more detailed analysis and identification of areas within the PSSA that were at greatest risk from shipping activity. Therefore it is suggested that the existing TMAP should be modified to include additional indicators that pertain directly to shipping, to assist with future monitoring and

evaluation of the PSSA. This aligns with the desirability for a common risk analysis and common framework to be instigated for the Wadden Sea PSSA.

4.3.4 The pressure, state, response framework provides a guide to future monitoring measures that may be adopted for further evaluation. These may include a more robust collection of current data, the generation of new indicators and a clearer connection between maritime activity and environmental quality.

4.3.5 Co-ordination monitoring and collection of appropriate data across all three countries would help ensure that compatible and comparable information was available which could be utilised to undertake an overarching risk assessment of the area. It is suggested that the undertaking of such a risk assessment could be beneficial in order to maintain and improve on current levels of shipping safety.

4.3.6 From maps within the QSR reports it is evident that sampling locations are distributed around the Wadden Sea, but there are limited sites within the shipping lanes of the estuaries. Sampling sites should include areas within both the shipping lanes and the seaward side of the islands to enable identification of shipping related impacts to be measured in addition to those relating to land based sources and river inputs.

4. 4 A central shipping incident reporting database should be developed specifically for the Wadden Sea PSSA. The reporting criteria should at a minimum include clear geographic co-ordinates (Lat/Long), an estimate of area covered (for oils spills/slicks), a classification of incident type and any resulting action taken. Relevant data could be incorporated within TMAP (see 4.3).

4.4.1 The findings of this evaluation have highlighted that monitoring and reporting of shipping accidents, incidents and near misses in the Wadden Sea PSSA is an area that needs to be addressed. At present there is no central database or unified reporting system and current reporting procedures vary greatly, both qualitatively and quantitatively.

4.4.2 The existence of EMSA should help to improve the situation; however the establishment of a comprehensive reporting system will take some time to develop and may not actually meet the needs of an effective monitoring programme.

4.5 There should be a concerted effort amongst all States to raise the level of *awareness and education of the PSSA and its function amongst all stakeholders.* Consistent, appropriate and adequate promulgation of the PSSA *to* mariners must be addressed and improved as a matter of urgency.

4.5.1 Stakeholders should be considered as potential advocates of PSSAs. Stakeholders should include everyone who has a vested interest in the area as well as those whose livelihoods depend on the sea. From the findings of a stakeholder questionnaire undertaken for this evaluation it was clear that the level of awareness of the purpose of a PSSA varies dramatically. Whilst many people had heard of the term, knowledge of the actual purpose and location of the PSSA was poor. Some stakeholders who live in the Wadden Sea area were aware of PSSAs, however many did not know

that they lived beside or worked in one. The results that caused the most concern were those received from professional mariners and local pilots.

4.5.2 Lack of awareness amongst key stakeholders should be addressed through education. Promulgation of the PSSA to professional mariners must be enhanced, as whilst some were aware of PSSAs, the majority could neither identify locations or how they are marked on hydrographic charts.

4.5.3 It is strongly recommended that further awareness raising of the Wadden Sea PSSA should be undertaken. Environmental education for seafarers is very much in the hands of marine colleges and is generally not prioritised. It is suggested that maritime and fishing colleges are encouraged to invite organisations such as ProSea Foundation[18] to speak with the students to help raise their awareness.

4.5.4 The IMO is currently reviewing the Standards of Training Certification and Watch keeping (STCW) Code and the Dutch delegation are actively pursuing the inclusion of Marine Environmental Awareness education within the new code and it is recommended that the Danish and German delegation follow suit.

4.6 The development of a TSS along the shipping corridor from the Weser/Elbe into the Danish sector to the North should be considered as a possible future APM.

4.6.1 Whilst at present there is no clear evidence to suggest an urgent requirement, the development of future offshore installations, anticipated increase in traffic volumes in conjunction with the extensive number of ecologically and environmentally sensitive areas, suggests a TSS would help to reduce the vulnerability of the area and would assist with keeping vessels away from the wind farms being planned for this area.

[18] ProSea is an independent, non-profit, non-governmental educational organization based on the concept that ecological and commercial sustainability are attainable and should be a part of current and continuing education for all professionals connected to the sea. (www.prosea.info)

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5.1 IMO Resolutions and MEPC Session Agenda Items

5.1.1 Resolutions

Resolution A.927 (22) adopted 15.01.2002 – Guidelines for the designation of Special Areas under MARPOL 73/78 and guidelines for the identification of Particularly Sensitive Sea Areas

Resolution A.982 (24) adopted on 1.12.2005 – Revised Guidelines for the Identification and Designation of Particularly Sensitive Sea Areas.

5.1.2 MEPC Session Agenda Items

MEPC 48/7/2 - Identification and protection of Special areas and Particularly Sensitive Sea Areas: Designation of the Wadden Sea as a Particularly Sensitive Sea Area: Submitted by Denmark, Germany and the Netherlands

5.2 IMO Conventions

5.2.1 IMO Conventions in Force

International Convention on the Control of Harmful Anti-fouling Systems on Ships 2001.

International Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972 and 1996 Protocol.

International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 (MARPOL 73/78).

International Convention for the Safety of Life at Sea (SOLAS), 1974

International Convention on Standards of Training, Certification and Watch-keeping 1995.

The Protocol on Preparedness, Response and Co-operation to Pollution Incidents by Hazardous and Noxious Substances 2000 (OPRC-HNS Protocol).

5.2.2 IMO Conventions Adopted

The International Convention for the Control and Management of Ships Ballast Water and Sediments adopted in 2004.

The Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships adopted in 2009.

The Nairobi International Convention on Removal of Wrecks adopted in 2007.

5.3 EU Directives and Regulations

5.3.1 EU Directives

DIRECTIVE 2000/59/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 27 November 2000 on port reception facilities for ship-generated waste and cargo residues

DIRECTIVE 2005/35/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 7 September 2005 on ship-source pollution and on the introduction of penalties for infringements.

DIRECTIVE 2009/15/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 23 April 2009 on common rules and standards for ship inspection and survey organisations and for the relevant activities of maritime administrations.

DIRECTIVE 2009/16/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 23 April 2009 on Port State control.

DIRECTIVE 2009/17/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 23 April 2009 amending Directive 2002/59/EC establishing a Community vessel traffic monitoring and information system.

DIRECTIVE 2009/18/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 23 April 2009 establishing the fundamental principles governing the investigation of accidents in the maritime transport sector and amending Council Directive 1999/35/EC and Directive 2002/59/EC of the European Parliament and of the Council.

DIRECTIVE 2009/20/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 23 April 2009 on the insurance of shipowners for maritime claims.

DIRECTIVE 2009/21/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 23 April 2009 on compliance with flag State requirements.

5.3.2 EU Regulations

REGULATION (EC) No 782/2003 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 14 April 2003 on the prohibition of organotin compounds on ships [Official Journal L 115 of 9.5.2003].

REGULATION (EC) No 391/2009 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 23 April 2009 on common rules and standards for ship inspection and survey organisations.

REGULATION (EC) No 392/2009 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 23 April 2009 on the liability of carriers of passengers by sea in the event of accidents.

APPENDIX A

EVALUATION OF PSSAS: DEVELOPMENT, LEGISLATION & EFFECTIVENESS

The IMO defines a PSSA as

"…..an area that needs special protection through action by IMO because of its significance for recognized ecological or socio-economic or scientific attributes where such attributes may be vulnerable to damage by international shipping activities". Resolution A.982 (24)

The following questions are asked in order to identify key issues and areas of concern with PSSAs. You may be as brief or as expansive as you wish with your answers. Please feel free to refer to any literature that in your opinion expands your answer. Once results have been received from all participants we will identify key elements that will be circulated for further discussion.

1. Do PSSAs currently fulfil their function as an effective protective mechanism? If not, why not? And if so, in what ways?

2. Do you think that the current PSSAs designations are appropriate? Please identify and give brief reasons for your answer.

3. Could the designation process be improved? If so how?

4. Could the legislative process be improved? i.e. Could the legal framework benefit from additions/modification to give a designated area more protection

5. In your opinion do you feel that **all** stakeholders are adequately and appropriately informed about the function and purpose of PSSAs? If no, please explain.

6. Do you feel that existing Associated Protective Measures (APMs) allow sufficient protection for a designated area?

7. What (if any) additional APMs that are not presently available within the present guidelines set by the IMO, do you feel may be appropriate to enhance level of protection?

8. When evaluating the effectiveness of a PSSA, which criteria would you suggest were included? Please rank you criteria in order of importance (1 being most important)

		General	*General*		*Specific*		
Type	**Indicator**	**Strength of link to maritime activity**	**Potential risk to Marine Environment**	**Value**	**Relevant strength of indicator to PSSA**	**Relevance SSU**	**SC**
P	Shipping Volume by type	5	4	9	5	45	40.5
P	Shipping incidents - all	5	4	9	5	45	45
P	Collisions - low impact	5	4	9	5	45	31.5
P	Collisions - High impact	5	5	10	5	50	50
P	Oil spills reported	5	4	9	5	45	36
P	Oil spill by volume	5	4	9	5	45	45
*P**	*Oil spill by type*	*5*	*4*	*9*	*5*	*45*	*
*P**	*Loss of cargo/containers*	*5*	*3*	*8*	*4*	*32*	*
P	Oil & gas production	5	3	8	5	40	24
P	Wind Farms in situ	5	2	7	3	21	28
P	Wind Farms - proposed	5	3	8	4	32	27
P	Dredged spoil - removed	5	4	9	4	45	22.5
P	Dredged spoil - dumped	5	3	8	4	32	32
P	Fishing	5	2	7	3	21	24.5
P	Shell fishery	5	2	7	3	21	24.5
P	Marine tourism by number	4	3	7	3	21	24.5
P	Marine tourism by activity	4	3	7	4	28	24.5

P **Pressure**

S **State**

R **Response**

*P** *Added by SC in Bremen*

High relevance

Moderate relevance

Low relevance

PRESSURE, STATE, RESPONSE INDICATOR SUITE

		General	*General*		*Specific*		
Type	**Indicator**	**Strength of link to maritime activity**	**Potential risk to Marine Environment**	**Value**	**Relevant strength of indicator to PSSA**	**Relevance SSU**	**SC**
S	Winter nitrate concentration	1	2	3	3	9	9
S	Winter phosphate concentration	1	3	4	3	12	12
S	N:P ratio	1	3	4	3	12	14
S	Chlorophyll a concentration	1	2	3	3	9	7.5
S	TBT concentration	4	3	7	5	35	31.5
S	Pesticide/organochloride - bird eggs	0	1	1	0	0	2.5
S	Heavy metal concentrations	1	3	4	3	12	8
S	Non indigenous species by number	4	5	9	5	45	31.5
S	Marine mammals by number	2	2	4	4	20	8
S	Landed catch - blue mussel	3	3	6	3	18	15
S	Landed catch – cockles	3	3	6	3	18	15
S	Landed catch – shrimp	3	3	6	3	18	15
S	PAH in sediments/shellfish	3	3	6	3	18	17.5
S	Oiled birds	3	2	5	3	15	25
S	Marine litter - total number	2	3	5	3	15	20
S	Marine litter – type	2	3	5	4	20	20
R	APM development	5	3	8	5	40	36
R	Communication to mariners	5	4	9	5	45	45
R	Local agreements	4	3	7	3	21	31
R	Co-ordination between states	5	4	9	4	36	45
R	Oil spill response plans	5	4	9	5	45	45
R	Stakeholder education/awareness	5	4	9	4	36	31.5

P **Pressure**

S **State**

R **Response**

High relevance

Moderate relevance

Low relevance

Indicator	Source	Availability
Winter nitrate concentration	TMAP & QSR 2004/2009	TMAP only shows levels over short period of time (winter months) so monthly means throughout the year were sourced from chapter's author. From 1989 to present
Winter phosphate concentration	TMAP & QSR 2004/2009	
N:P ratio	TMAP & QSR 2004/2009	Data available since late 1970s, mainly in graph format.
Chlorophyll a concentration	TMAP & QSR 2004/2009	Data collected since the late 1970s mainly in graph format.
TBT concentration	TMAP & QSR 2004/2009	Data collected since the 1990s mainly in graph format.
Pesticide/organochloride - bird eggs	TMAP & QSR 2004/2009	Data collected since the 1980s mainly in graph format.
Heavy metal concentrations	TMAP & QSR 2004/2009	Data collected since the 1980s mainly in graph format
Non indigenous species	QSR 2004/2009	Many species have been identified some dating back as far as the 1920s.
Marine mammals	TMAP & QSR 2004/2009	Data available since 1980s
Landed catch - blue mussel	TMAP & QSR 2004/2009	Locations of beds and fisheries, quantity landed
Landed catch – cockles	QSR 2004/2009	
Landed catch – shrimp	QSR 2004/2009	
PAH in sediments/shellfish	TMAP & QSR 2004/2009	Data available from QSR 2004 since 1987, mainly in graph format.
Oiled birds	TMAP & QSR 2004/2009	Data collected since 1982, mainly in graph format
Marine litter	QSR 2004/2009. OSPAR QSR 2010	Types & volumes, source of the marine litter cannot be clearly established.
Shipping Volume by type	ISL Yearbooks	Not available through trilateral States, figures from the Northern Range ports (includes non-Wadden Sea ports)
Shipping incidents – all	See table in Appendix D	Data limited and inconsistent.
Oil & gas production	UKHO nautical charts 1423 and 1408	The charts show the production platforms and pipelines.
Wind Farms in situ	BSH & spatial planning document, UKHO charts 1423 & 1408	The charts show all existing and all under construction.
Wind Farms – proposed	BSH & spatial planning document	Full list of all proposed wind farms, but lacks specific locations (no co-ordinates).
Dredged spoil – removed	OSPAR	Removed from river estuaries and harbours. Data collected since 1989, showed as a graph and map of sites.
Dredged spoil – dumped	OSPAR	Graph and maps from OSPAR
Fishing	QSR 2004/2009	Quantity landed

INDICATOR SUITE - DATA AVAILABILITY TABLE **APPENDIX C**

Indicator	Source	Availability
Shell fishery	QSR 2004/2009	Quantity landed
Marine tourism	QSR 2004/2009	Data collected since 1980s mainly shown in graph format
APM development	MEPC 48	TSS & DWR already existing, no further APMs proposed.
Communication to mariners	UKHO charts 1423 & 1408 BSH routing chart German Bight	PSSA not marked on UKHO charts. On BSH routing chart. Marked on Dutch and Danish charts. On some Electronic charts, not on UKHO Folio 5
Local agreements	Stade 1997, Schiermonnikoog Declaration	Full texts available.
Co-ordination between states	CWSS, TMAP, DENGERNETH, Schiermonnikoog Declaration	All of these agreements show that the three States are working together to some extent.
Oil spill response plans	DENGERNETH	Full plan available – not yet ratified by German and the Netherlands.
Stakeholder education/awareness	Questionnaire carried out by SSU with help from trilateral States.	Wide range including: German & Netherlands stakeholders both on and offshore, seafarers from Warsash Maritime Academy UK. Data from Denmark incompatible.

		Germany		The Netherlands	Denmark
		Lower Saxony	Schleswig-Holstein		
Shipping incidents	Data range	1990 to present from WSD North-East	From 2005 to present from WSD North	2006 only – from MARIN report	From 2000 to present – from Danish Admiralty
	Ship type	Recorded	Not recorded	Not recorded	Not recorded
	Location	Co-ordinates given	Initial data no co-ordinates New data received including co-ordinates	No co-ordinates but map with specific areas which could be used for GIS model.	Co-ordinates given
	Type of incident	Recorded- 'collision'	Recorded	Recorded	Limited
	Cause of incident	Recorded- 'false navigation'	Recorded	Not recorded	Not recorded
	Damage caused	Recorded – 'total loss'	Recorded- 'damage to both vessels'	Not recorded	Not recorded
	Number of injuries	Recorded- personal injuries-deaths/heavy /light injuries	Not recorded	Not recorded	Not recorded
Collision–low impact		All of the collisions reported can be seen as low impact.			
Collision-high impact		For all three countries no high impact incidents have been reported since the Pallas in 1998.			
Oil spills reported		Limited 'fuel lost' 'pollution to the environment' – no specifics	None recorded in shipping data.	None recorded in shipping data.	Reported – 'spill from ship' 'suspected oil stain' 'land based oil'.
	Bonn Agreement	Data from aerial surveillance shows images of oil density and oil spills of the North Sea & Wadden Sea			
Oil pollution by type		Not recorded – 'fuel lost' no type given.	Not recorded	Not recorded	Type of oil is recorded, e.g. mineral oil & gasoline
Oil pollution by volume		For all three countries no amounts of oil were recorded in the event of a spill.			

SOURCES OF SHIPPING DATA

Appendix E

Questionnaire for Stakeholders

Occupation

Nationality

Age

1a. Have you heard of a Particularly Sensitive Sea Area (PSSA)?

Yes No

1b. If yes, what do you think a PSSA is for?

2. How did you hear about PSSAs?

3. Could you identify the location of any PSSAs?

4. How is a PSSA marked on a nautical chart?

Thank you for your time

RESULTS

Question 1. Have you heard of a Particularly Sensitive Sea Area (PSSA)?

In total 88 stakeholders completed the questionnaire, of these 63 had heard of the term PSSA and 25 had not.

Figure I. Respondents by job category who had heard of a PSSA

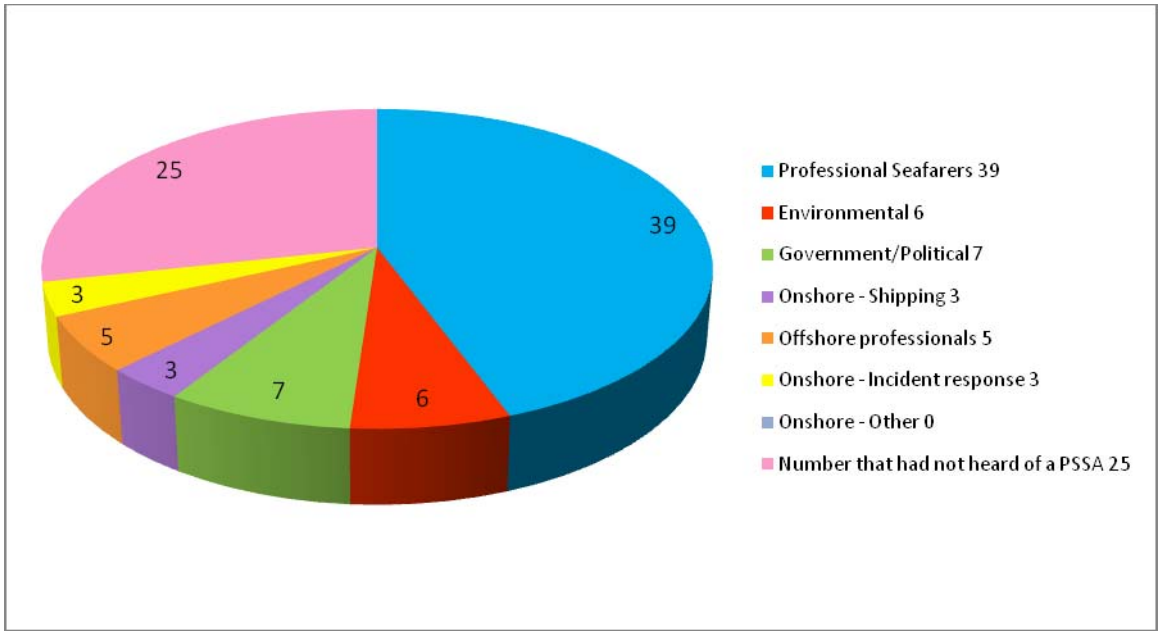
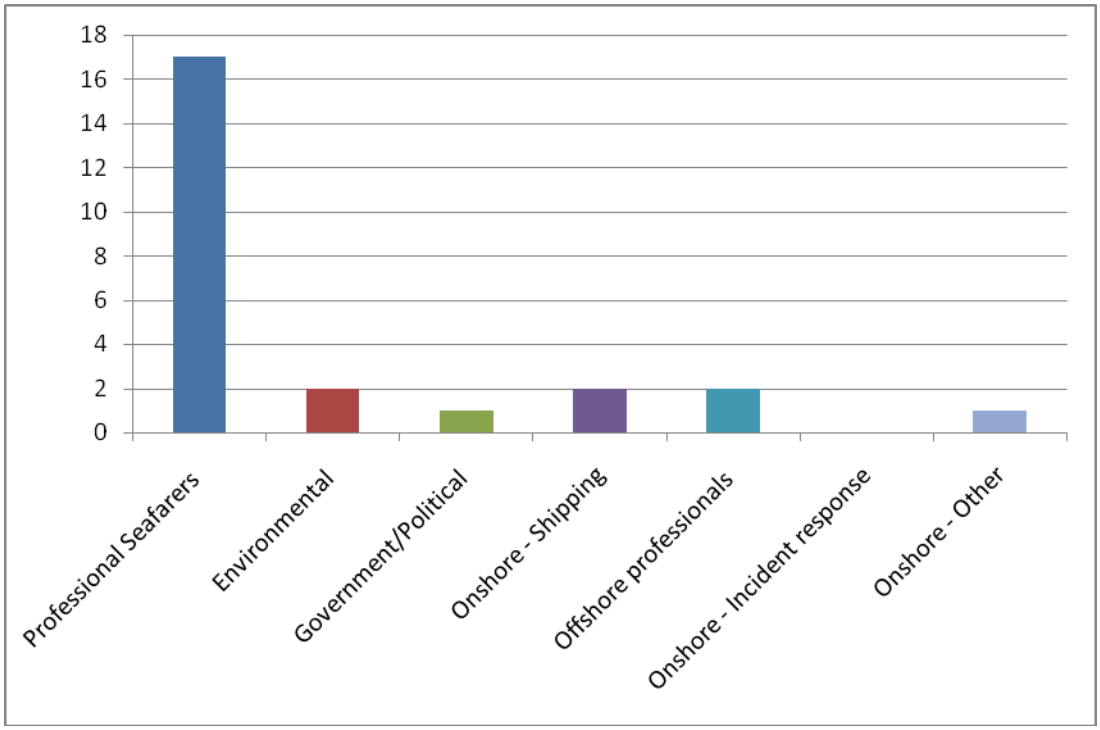


Figure II. Respondents by job category who had not heard of a PSSA

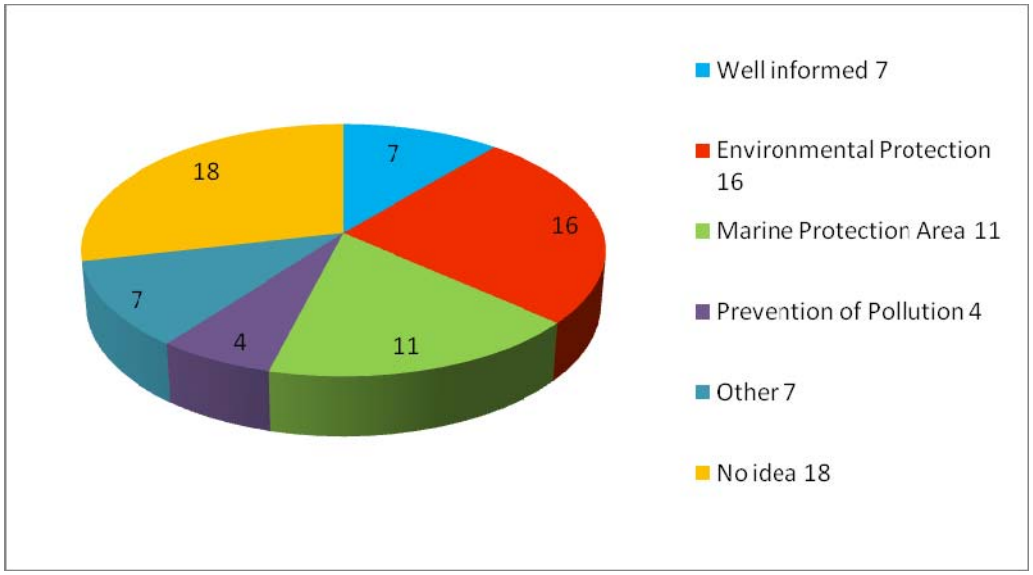


63 stakeholders went on to answer question 1b.

Question 1b. What do you think a PSSA is for?

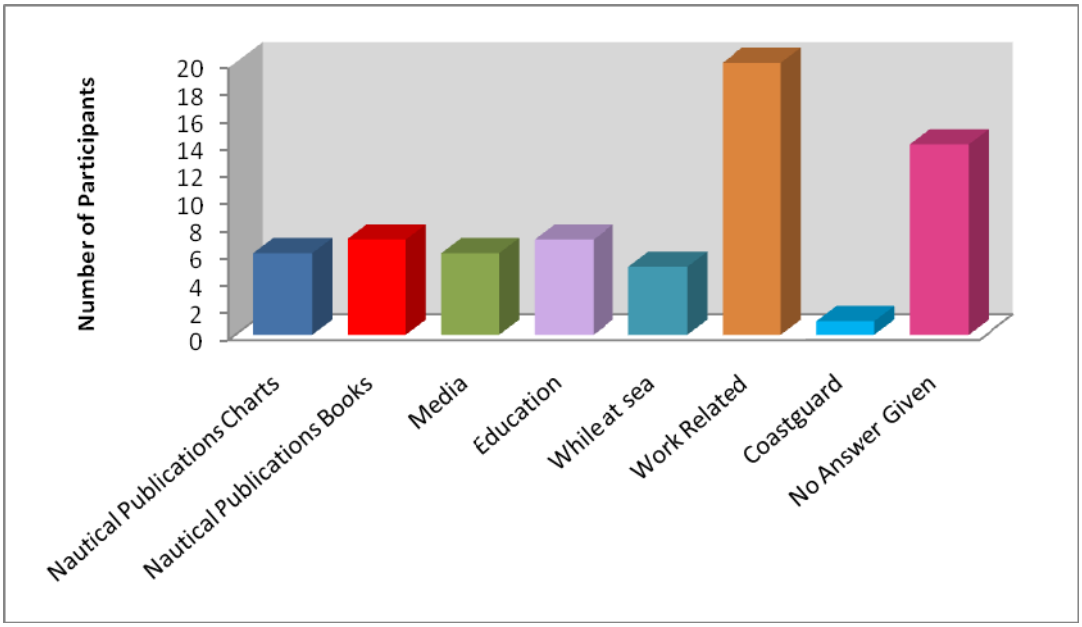
7 respondents were well informed and could explain what a PSSA is correctly, 18 of the respondents had no explanation.

Figure III. Respondents knowledge of purpose/function of a PSSA



Question 2. How did you hear about PSSAs?

Figure IV. How respondents had heard of PSSAs



Question 3. Could you identify the location of any PSSAs?

A wide variety of locations were identified around the world. Areas identified included 6 PSSAs and 7 MARPOL Special Areas; however most of these were identified by only a single respondent with the exception of the Great Barrier Reef and Florida Keys which were identified by a total of 21 respondents. The Wadden Sea PSSA was identified by 18 respondents; however these respondents all lived/worked in the Wadden Sea Area. None of the seafarers identified the Wadden Sea as a PSSA.

Question 4. How is a PSSA marked on a nautical chart?

Only 7 respondents knew how a PSSA was marked on a nautical chart. (Dotted/coloured line with notes on the chart). An additional 7 respondents did identify dotted/coloured lines; however this is a standard format for delineating areas of interest on all nautical charts.

Figure V. How the respondents thought a PSSA is marked on nautical charts