Managing Denmark's Marine Environment
– New Ways Forward –

Alexander John Webster

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The Division of Geomatics
Department of Development and Planning
The University of Aalborg

Foreword

I have included a foreword in this thesis to give the reader a better understanding of the background behind the research as well as to state my personal aims and expectations.

Two years ago, I would never have dreamt of going on exchange or exploring management issues about the Danish marine environment, nonetheless I have done exactly that. Due to the close link between the Geomatic departments, meeting Danish exchange students in Australia and the travel bug, I selected The University of Aalborg. My interest in the topic grew from the existing work being done in my department, the exciting prospect of a relatively new field of research and the chance to apply it to *uncharted waters*.

My personal aim of this thesis was to challenge myself by studying in a different country with an unfamiliar environment and different style of learning. By doing this, I hoped to learn new skills but also enjoy the experience of the journey. My hopes for this thesis are not that it will revolutionise the current Danish marine management system, but perhaps be a small part of it. If this thesis helps give ideas to people or aids future research, then I will be happy.

Abstract

Denmark is a relatively small country that lies between two seas: North Sea and Baltic Sea. Since the Viking Age, Denmark has gained wealth and power from the ocean. Today still, the Kingdom of Denmark gains significantly from its marine territories. Since 1992, with the adoption of Agenda 21 at the United Nations Conference on Environment and Development, there has been a new global agenda of sustainable development. This coupled with the 3rd United Nations Convention on Law of the Sea has created a need for countries to align marine management with this new agenda. Primarily due to historical reasons, the current marine management system in Denmark is sector-based and does not have an overarching policy, strategy or integrated system.

Many internal and external factors would need to be considered if a new holistic management system were to be design and implemented. Globally and regionally, Denmark is a partied to many treaties, conventions and agreements relating to how it exploits, manages and preserves its marine environment. Within Denmark, there are many different stakeholders that have vested interest in how the marine environment is managed. It is clear from international efforts that spatial data is the key to maximising benefits from administration. A cadastre can be used to help this administration, as part of a broader integrated spatial data infrastructure (SDI), by creating a fundamental underpinning layer.

For this integrated holistic marine management system to be realised, further investigation is need to identify the most approach unique solution for Denmark and the best way to implement such a system considering all influencing factors in the Danish context.

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Finally thanks go to my family for constantly being there, despite phoning for mundane issues, like getting me to fix the Internet in Hawthorn from Denmark. Last but not less, thanks to Nic for always being at the other end of emails and sending me photos – I will be in Japan soon.

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Abbreviations and Acronyms

ASDI	Australian Spatial Data Infrastructure
BSHC	Baltic Sea Hydrographic Commission
CBSS	Council of the Baltic Sea States
CERCO	Comité Européen des Responsables de la Cartographie Officielle
MEGRIN	Multi-purpose European Ground Related Information Network
CFP	Common Fisheries Policy
CONSSO	Committee of North Sea Senior Officials
CSC	Coastal Services Center
DCA	Danish Coastal Administration
DEA	Danish Energy Authority
DKK	Danish Kroner
DMA	Danish Maritime Authority
EEA	European Economic Area
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
EMSA	European Maritime Safety Agency
ENC	Electronic Navigational Chart
EPA	Environment Protection Agency
ERDF	European Regional Development Fund
EU	European Union
FAO	Food and Agriculture Organization
FIG	Fédération Internationale des Géomètres
GEOIDE	Geomatics for Informed Decisions
GIS	Geographic Information System
HELCOM	Helsinki Commission
ICES	International Council for the Exploration of the Sea
ICZM	Integrated Coastal Zone Management
IDON	Interdepartmental Deliberations Over North Sea governance
IHO	International Hydrographic Organization
IMCO	Inter-Governmental Maritime Consultative Organization
IMO	International Maritime Organisation

INSPIRE	Infrastructure for Spatial Information in Europe
KIMO	Kommunenes Internasjonale Miljorganisasjon Organisation
KMS	Kort & Matrikelstyrelsen) National survey and cadastre
LME	Large Marine Ecosystem
MGDI	marine geo-spatial data infrastructure
MPEC	Marine Environment Protection Committee
NGO	Non Government Organisation
NHC	Nordic Hydrographic Commission
NMCAs	National Mapping and Cadastral Agencies
NOAA	National Oceanic and Atmospheric Administration
NSAOF	North Sea Offshore Authorities Forum
NSHC	North Sea Hydrographic Commission
OMHEC	Offshore Mechanical Handling Equipment Committee
OPIS	Ocean Planning Information System
OSPAR	Oslo and Paris Conventions
PCGIAP	Permanent Committee on GIS Infrastructure for Asia and the Pacific
PSSA	Particularly Sensitive Sea Area
RDANH	Royal Danish Administration of Navigation and Hydrography
SDI	Spatial Data Infrastructure
SWOT	Strength Weakness Opportunity Threat
TAC	Total allowable catch
UN	United Nations
UNCED	United Nations Conference on Environment and Development
UNCLOS	United Nations Convention on the Law of the Sea
UNEP	United Nations Environment Programme
UNRCC-AP	United Nations Regional Cartographic Conference for Asia and Pacific
VASAB	Vision and Strategies around the Baltic Sea
WSSD	World Summit on Sustainable Development

Danish Government Names

Below is a table translating the English names of key Danish Ministries and government bodies. I have included this table to avoid any misunderstanding, which was occasionally encountered during the research.

English	*Website*	*Danish*
Ministry of the Environment	**mim.dk**	**Miljøministeriet**
Danish Environment Protection Agency	mst.dk	Miljøstyrelsen
Danish Forest and Nature Agency	skovognatur.dk	Skov og Naturstyrelsen
National survey and cadastre	kms.dk	Kort & Matrikelstyrelsen
Ministry of Food, Agriculture and Fisheries	**fvm.dk**	**Ministeriet for Fødevarer, Landbrug og Fiskeri**
Fisheries Directorate	fd.dk	Fiskeridirektoratet
Ministry of Transport and Energy	**trafikministeriet.dk**	**Transport og Energiministeriet**
Coastal Authority	kyst.dk	Kystdirektoratet
Danish Energy Authority	ens.dk	Energistyrelsen
Ministry of Economic and Business Affairs	**oem.dk**	**Økonomi og Erhvervsministeriets**
Danish Maritime Authority	dma.dk	Søfartsstyrelsen
Ministry of Defence	**forsvaret.dk**	**Forsvarsministeriet**
Royal Danish Administration of Navigation and Hydrography	frv.dk	Farvandsvæsenet

1 INTRODUCTION

The intension of this Chapter is to setup the framework for this research. It contains some background information to the topic, the scope of the research and sets out research aims. From the background information, an initial problem statement will be formulated. Preliminary objectives will then be created to address the initial problem statement and accordingly design a methodology to attempt to solve it.

1.1 Background

The sea, washing the equator and the poles, offers its perilous aid, and the power and empire that follow it... Beware of me, it says, but if you can hold me, I am the key to all the lands.

Ralph Waldo Emerson (1803-1882)

What Emerson, an American poet and essayist, said over 100 years go, could not be more appropriate today. 71 % of the surface of the plant is covered by water, in this area there is great wealth and power to those who can 'hold' the ocean. We, humankind, could not have developed with out her 'perilous aid'. We do not inhabit the oceans, yet we are tied to it.

The oceans produce 70% of the planets oxygen and dominate the planet's weather systems. 60% of the global population lives within 64 kilometres of the sea. Humankind is undeniably linked and dependent on the ocean socially, environmentally and economically.

Denmark a relatively small country that lies between two seas: North Sea and Baltic Sea. In addition Greenland and the Faroe Islands, Danish territories under home rule, are situated in the North Atlantic Ocean. Since the Viking Age, Denmark has gain wealth and power from the ocean. Today still, the Kingdom of Denmark gains significantly from its oceans territory. While Denmark does not have a large marine territory, its holds claim to a diverse range of marine ecosystems and resources.

Given this diversity as well as its strategic position in the North Sea and at the entrance to the Baltic, there is an environmental, economic and social need to manage

its marine territory. While Denmark is aware of the need to manage effectively, currently there is a complex legal and institutional framework.

The marine environment is not simple to manage by its nature. There are many rights, restrictions and responsibilities, which can overlap and sometimes even compete. In addition fishing and shipping industries often cross international borders. Recently the 3rd United Nations Convention on Law of the Sea set up a universal framework or a *constitution* for the oceans, to help manage the oceans as a resource for all humanity.

In the last 20 years there has been a new agenda – Sustainable Development. The world community has identified the need to develop in a sustainable manner. Regional and global initiatives have brought countries together with a common goal. The most significant agreement for sustainable development is Agenda 21, which was created at the United Nations Conference on Environment and Development in 1992.

The goal of this thesis is to evaluate the global situation for marine environments, look at how Denmark is currently managing its marine environment and look for better ways of doing it.

1.2 Scope of the Research

This thesis will assess solely Denmark's marine environment. However to achieve this, global, regional and even specific countries' marine environments will be studied. Denmark's marine environment will be studied in its entirety, this includes all stakeholders as well as all living and non-living resources.

Topics to be included:

- *Global Issues* – this is only limited to issues that concern the management of marine environment. This includes pollution, shipping, biodiversity, fishing, oil and petroleum, boundary delimitation, international agreements to name a few.

- *Regional Issues* – As with global issues, only regional issues concerning the marine environment will be explored.

- *Case Studies* – Only Australia, Canada and the United States will be thoroughly explored as primary case studies. Other countries have been used like New Zealand and Netherlands, but only to highlight specific concepts and ideas.

- *Danish Marine Environment* – All areas of the Danish marine environment will be included. This means from the land-sea interface or coastal zone to the Exclusive Economic Zone boundary.

- *Spatial Dimensions* – As this research is being undertaking as part of a Surveying / Geomatics course, the intention in the later part of the research is only to investigate the spatial dimensions of a marine management system.

Topics not to be included:

- *Greenland and Faroe Islands* – The power sharing between the Danish State and home rule authorities is complicated. Internationally there status varies. For example, both these territories are not a part of the European Union and Faroe Island has its own associate membership to the International Maritime Organisation. Due to the extensive home rule arrangements for the Faroe Islands and Greenland, the waters surrounding these Danish territories will not be included in this thesis.

- *Inland Waters* – Denmark has many inland waters and fjords. Despite some of the fjords being filled with salt water and Limfjord splitting north Jutland, this thesis will not include any of these areas.

- *Technical Issues* – This thesis does not aim to analyse technical issues in regards to managing Denmark's marine environment. Mathematic algorithms and surveying techniques of the oceans will not be assessed. Specifications of the current system will not be reviewed, rather a more general understanding of the concepts and theories currently will be employed.

- *Implementation Issues* - This thesis does not aim to select or design a model for the marine management. Consequently while mentioned briefly, implementation issues of managements systems will not be discussed.

1.3 Research Aims

There are two aims of this thesis.

1) To identify a need for a better marine management system in Denmark.
2) To identify challenges, barriers and benefits in adopting or implementing a new marine management system.

1.4 Initial Problem Statement

The health of the oceans is critical to humankind. It is clear that humankind's growth and development over the last century has had an adverse affects on the health of the planet including its marine environments. It has been recognised by the world community that our current development practise and patterns are unsustainable. In recent years to curb this effect, the global community has united to tackle the problems. The natural environment does not recognise country boundaries, thus it is essential that *all* nations take responsibility for their environment but also work together closely. While there is a global consensus with the new agenda of sustainable development, the responsibility of implementation still lies with individual countries.

Denmark is a very old country, and due to it location and history it has many links to the ocean, which its gains economic, social and cultural benefits. Historically, its ability to sail the oceans gave it the capacity to conquer, fish and trade. Its location has given it strategic power for centuries and still does today. In the last century new technologies and discoveries have given Denmark even further rewards from the sea like oil and gas production, large scale finish, wind turbine farms as well as nature conservation and tourism income. However with these benefits, come responsibilities. Over many years Denmark has built up processes, structures and system to manage its marine territories. This management regime have evolved to address technological advancements of the day and the changing relationship humankind has with the ocean. The latest evolution of this relationship is the adoption of the new global agenda of sustainable development. Consequently, the existing regime has to be review to see if it is aligned with the goals of sustainable development.

Initial Problem Statement: *i) is there a new global agenda? ii) Are countries currently altering their marine management systems to align with this new agenda? iii) Is there a need for Denmark to change its existing system and look for new approaches?*

1.5 Preliminary Objectives

The main goal of this thesis is to examine how the Danish marine environment is managed and if it could be improved. To begin, the first research aim will be addressed by the confirming assumptions that there is a new global agenda and that there is a *need* to tackle this issue in Denmark. Three preliminary objectives have been created to substantiate these assumptions.

- *Analysis of the current global situation* (Chapter 2) – This includes reviewing the history of law of the sea and the marine environment. Specifically apprising what the world community has done to address problems and challenges.

- *Examine specific country case studies* (Chapter 3) – Looking at a few key countries' marine management systems. Examine how these countries have implemented global initiatives, approached problems and created unique solutions. The history, approach, and rationale of their initiatives will be explored.

- *Assess Denmark's current marine environment* (Chapter 4) – To gain a better understanding of the Danish marine environment, it will be profiled. This profile will include a description of the physical environment, historical context of management, review of the current management structure within the government as well as specific key government authorities.

1.6 Methodology (Part One)

By its nature it is hard to evaluate administration systems with a quantitative approach. While quantitative data can be gathered through questionnaires and comparative structures, it is easy for it to be misinterpreted with poor design or collection methodology. Qualitative data can better appraise the circumstance, but is hard to directly compare and contrast. While it would have been good to use both types of data in this research, due to time and resource constraints, only qualitative methods have been used.

Literature reviews – the main source of evidence and information has come from reading journals, academic papers and reports. In this age of e-governance, most necessary information is accessible via government websites. This method was used for Chapters 2, 3, and 4.

Interviews – initial literature reviews proved that it was hard to gather a good understanding of how the Danish marine environment was management from (limited) English texts and government websites. One problem of Danish government websites was that the English versions sometimes were not complete. Often clicking the link would reveal a site with significantly less text and links than the original Danish version. The other problem was that occasionally there was no English version.

To overcome this problem, interviews were arranged with key government agencies involved with the management of the Danish marine environment. A list of the people interviewed can be found in Appendix A. The interviews were designed to confirm understanding of current management practices, but also gain a better perceptive of how the different government agencies interacted with each other. In preparation for the interviews, background material and questions were sent in advance to all interviewees. This material can be found in Appendix B. While the questions from the interview material were generally not answered directly, it gave excellent points for direction of discussions. While the information from the interviews was primarily used in Chapter 4, it also helped identify issues, problems and challenges with the current system for later in the report.

SWOT Analysis – As a method of organisational, institutional and structure analysis, a SWOT Analysis was conducted by a way to conclude Chapter 4.

Report Structure – Below is a diagram of the structure of the first part of the report. It can be seen that after formulating the initial problem statement in Chapter 1, the next three Chapters will run in parallel to each other addressing a different objective. With the knowledge and information from these Chapters, it is hoped that the initial problem statement will be answered and a second more specific problem statement will be created. Once this second problem statement is create, further objectives will be formulated and appropriate methods used to address the new objectives.

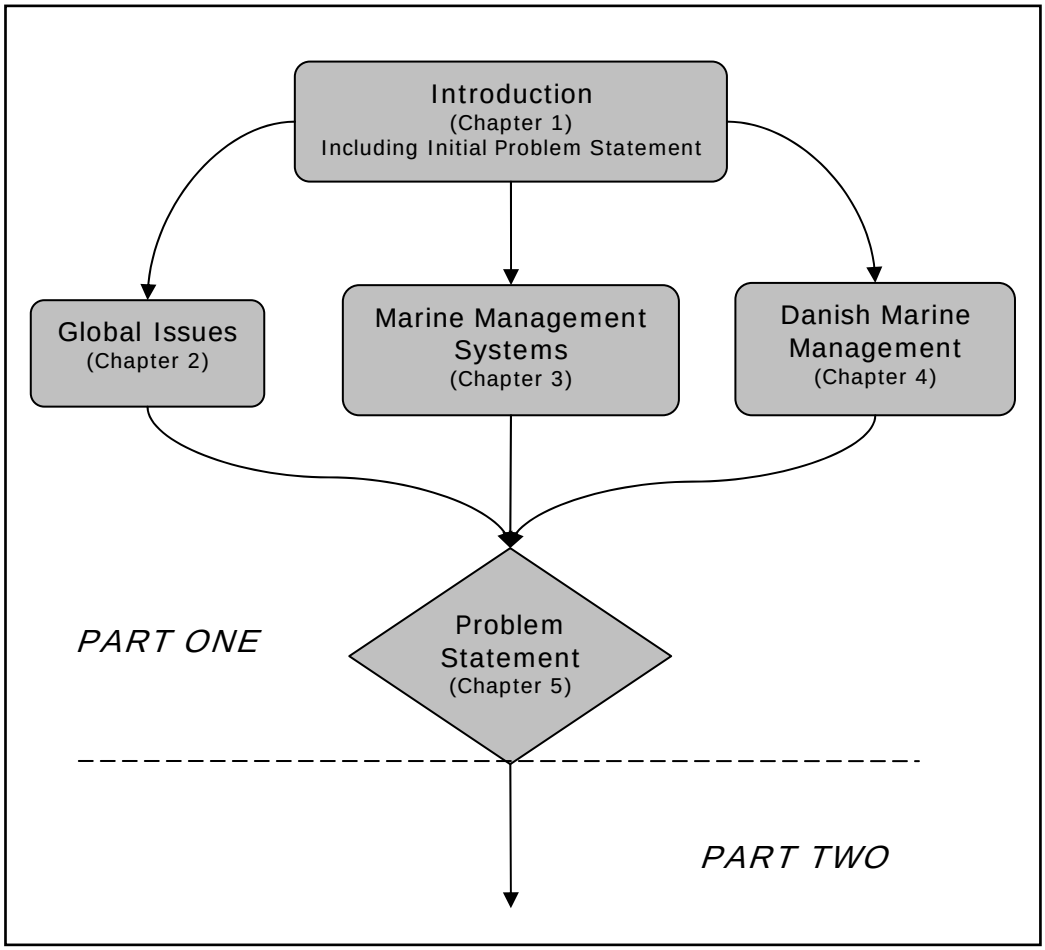


Figure 1.1 – Report Structure: Part One

PART ONE

This part of the report will endeavour to address the first aim of the thesis, ‘y*o identify a need for a better marine management system in Denmark’*. This will be achieved through the method set out in section 1.6.

This part includes:

- Analysis of the current global situation (*Chapter 2*)
- Examine specific country case studies (*Chapter 3*)
- Assess Denmark’s current marine environment (*Chapter 4*)
- Formulate a problem statement (*Chapter 5*)

2 GLOBAL SITUATION

The intension of this Chapter is to give a context to the state of the world's oceans, then examine the Law of the Sea as well as sustainable development initiatives. In examining the Law of the Sea and sustainable development, a historical context will first be given followed by key initiatives.

2.1 Context

80% of all life on earth is found under the ocean surface. The algae, the first plants on earth, developed in the oceans some 3.5 million years ago. All plants including algae produce oxygen as a by-product as they consume food. The oxygen produced by algae produces over half the oxygen that humans breathe. 95% of the habitat space on the planet is found in the oceans, and as a result the diversity of species far out weighs that found on the land.

The recreational uses of the oceans particularly along the coastline are almost endless: from yachting to sailing, power boats to canoes and kayaks. The recreational use of the ocean also creates and generates associated industries like tourism. Culturally many artists have been inspired by the ocean and its seas. Fortunes have been won and lost at sea. The sea still holds a mystery of the unknown, that exists no where else on the planet. These all could be reasons why 14 of the world's 15 largest mega cities (10 million or more people) are situated on the coast.

The ocean has a vast array of resources that are exploited by humans. From oil to tin, diamonds to gravel, metals to fish, the resources of the sea are enormous. As technology advances, we find new ways and things to exploit from it. Fish are the principle source of protein for more than one billion people. Products made from gas and petroleum drive the modern industrialised world. As the majority of the oceans are unexplored, new resources deposits and ways to exploit the ocean are still being discovered. Substances out of seaweed are used in photographic film, cotton thread, medicines, paint, face creams, soup and ice cream. While aviation is now the primary mode of transport for people, still around 90% of trade between countries is carried by ships.

Despite our fondness and dependence on the ocean, less than 10% of it has been explored. In fact, more people have travelled into space than have ventured into the deep. In the last 100 years the world population has gone from 1.6 billion in 1900 to 6.1 billion in 2001. This unprecedented population growth coupled with technological advances has put huge pressure on the earth's living and non-living nature resources. Yet it is not just the size of this growth that is a problem. The uneven distribution and gap between more and less developed countries has also magnified the effects. The richest fifth consumes 86% of all goods and services, and produces 53% of all carbon dioxide emissions. While the poorest fifth consumes 1.3% of goods and services, and accounts for 3% of carbon dioxide output (UN, 1998).

While in some parts of the world, population growth is slowing and has even stopped in some developed countries, the world population as a whole continues to growth. Each year the world population increases by an estimated 77 million people. This is expected to continue for many years. Predictions have the world's population at between 7 to 10½ billion people by 2050 and not necessarily stopping, again with most of the increase being in the world's poorest and least developed countries.

Over this same period of rapid population growth, there has been a dramatic change in the global environment. Half of the world's original forest cover has been cleared, with another 30 percent classified as degraded. Three quarters of the world's fish stocks are now fished at or beyond sustainable limits. Industrial fleets have fished out at least 90 per cent of large ocean predators (tuna, marlin and swordfish) in the last 50 years. As a result of fossil fuel consumption, carbon dioxide levels today are 18 per cent higher than in 1960 and an estimated 31 per cent higher than at the onset of the Industrial Revolution in 1750. Accumulation of greenhouse gases in the atmosphere, including carbon dioxide, is tied to rising and extreme change in temperatures, and more severe storms. Sea level have risen an estimated 10 – 20 centimetres, largely as a result of melting ice masses and the expansion of oceans linked to regional and global warming. Small island nations and low-lying cities and farming areas face severe flooding or inundation.

This stress on the earth's environment is not merely a result of rapid population growth but also due to unsustainable consumption and production patterns. Both

factors combined can be attributed to the stress placed on the environment and the depletion of natural resources. There is a joint need for the developing world to curve its growth rate as well as the developing world to curve its affect on the environment.

The international community has addressed these problems in two main ways; increased awareness and practice of sustainable development principles and better regulations and framework for managing the oceans, as the regulators of the planets environment.

2.2 Sustainable Development

Without a healthy planet, no one can survive. Consequently it is critical that all people work together and help each other to manage the health of the planet. Due to environmental changes over the past 50 years, it has been identified as critical to manage the environment sustainable. Through the United Nations, numerous initiatives have been created. The most significant being the Conference on Environment and Development in 1992. The most important outcome of this conference was the adoption of Agenda 21 – a programme of action to achieving sustainable development.

2.2.1 History

The first time the health of the earth's environment was placed on the international agenda was in 1972, at the United Nations (UN) Conference on the Human Environment held in Stockholm. The major outcome from that conference was the establishment of the UN Environment Programme (UNEP), which is still functioning today. In the succeeding years, little more was done to address environmental concerns. Environmental stress and damage at all levels continued without little international acknowledgement or cooperation.

In 1983, the UN set up the World Commission on Environment and Development to further investigate the full picture of how and why environment degradation was occurring. The Commission put forward the concept of sustainable development as an alternative approach to growth, rather than short term economic gain.

> *"Development that meets the needs of the present without compromising the ability of future generations to meet their own needs"*

In 1987, the UN General Assembly called for the UN Conference on Environment and Development (UNCED). The primary goals of the conference were to promote development that supported socio-economic growth and prevent environment deterioration, and to lay a foundation for a partnership between all countries, based on mutual needs and common interest that would ensure a healthy planet for the future.

2.2.2 Rio de Janeiro 1992

The UNCED was held in Rio de Janeiro, 1992. Informal know as *The Earth Summit*, was represented by 172 governments, 108 at the level of heads of State or Government. The conferences attendance and response by people and nations was unprecedented and set standards for future UN conferences – 2,400 representatives of non-government organizations (NGO) and 17,000 people attended the parallel NGO forum. Twenty years after the first global environment conference, the UN sought to help Governments rethink how their countries develop. The conferences aimed to find ways to halt the destruction of finite natural resources and pollution of the planet.

The main message was “that nothing less than a transformation of our attitudes and behaviour” would bring about the necessary changes. This reflected the complexity of the problems, acknowledging that poverty as well as affluent consumption practices place stress on environments.

The two-week conference was the culmination of a process that began three years earlier. During those years planning, education and negotiation among all member States of the United Nations was done in preparation for the conference. The biggest achievement of the conference was the adoption of Agenda 21. This was a comprehensive programme of action for global action in all areas of sustainable development. At the close, Maurice Strong, the Conference Secretary-General, called the Summit a “historic moment for humanity”. In adopting Agenda 21, the Earth Summit also requested the United Nations to initiate talks aimed at halting the rapid depletion of certain fish stocks and preventing conflict over fishing on the high seas.

Agenda 21 aims to provide governments with a basis from which sustainable development initiatives may be developed and implemented, and is the first document recognising the role of civil society in an attempt to address social, environmental and development efforts on an international stage. While many Chapters of the Agenda

that include the marine environment, Chapter 17 addresses maritime issues specifically.

> *Protection of the oceans, all kinds of seas, including enclosed and semi-enclosed seas, and coastal areas and the protection, rational use and development of their living resource.*
>
> *(*Agenda 21, Chapter 17)

Chapter 17 calls for "new approaches to marine and coastal area management and development, at the national, subregional, regional and global levels, approaches that are integrated in content and are precautionary and anticipatory in ambit". By mid-1996, some 100 governments had established national sustainable development councils or other coordinating bodies. More than 2,000 municipal and town governments had each formulated a local Agenda 21 of their own.

2.2.3 Johannesburg 2002

When the UN authorising the World Summit on Sustainable Development (WSSD), everyone knew that progress since 1992 had been disappointing. Poverty had deepened and environment degradation had continued. Consequently the focus of the Summit was not about further negotiation and debate but rather implementation, action and results. As an implementation focused conference, no new agreements or conventions where agreed upon. Rather some important targets were set upon:

- To halve the proportion of people without access to basic sanitation by 2015.
- To use and produce chemicals by 2020 in ways that does not lead to significant adverse effects on human health and the environment.
- To maintain or restore depleted fish stocks to levels that can produce the maximum sustainable yield on an urgent basis and where possible by 2015.
- To achieve by 2010 a significant reduction in the current rate of loss of biological diversity.

Summit Secretary-General, Nitin Desai, posed the question "will Johannesburg make a genuine difference? … that has to be the test for an implementation conference." For the first time, documents were not the sole product of the Summit. While negotiations did makeup the majority of the attention, 300 voluntary partnerships were launched. These partnerships, tied to the government commitments and provide a built-in

mechanism to ensure implementation. There was a new level of dialogue in Johannesburg between all the stakeholders, especially between governments, civil society and the private sector.

United Nations Secretary-General Kofi Annan, pointed out that following through on these commitments will be the yardstick of success or failure. "We invited the leaders of the world to come here and commit themselves to sustainable development, to protecting our planet, to maintaining the essential balance and to go back home and take action."

By any indication, there was substantial interest in the Summit. One hundred world leaders addressed the Summit and more than 22,000 people participated in WSSD, including more than 10,000 delegates, 8,000 NGOs and representatives of civil society, and 4,000 members of the press.

Danish Prime Minister Anders Rasmussen at the time President of the European Union, said "The conference has concluded a global deal recommending free trade and increased development assistance and had committed to good governance as well as a better environment." He added, "Now the time has come for implementation, at the national and international levels. It is time to deliver."

2.3 Law of the Sea

The law of the sea is one of the oldest disciplines in international law. However, in the twentieth century the three hundred year old Freedom-of-the-sea Doctrine has been challenged. Due to increasing tensions between sovereign States, over the use of the oceans as a resource and environmental concerns, there was a need to find better ways to divide and manage the sea. The result was diplomatic negotiation via the United Nations and was the creation of the 3rd United Nations Convention of the Law of the Sea, which came into force in 1994.

2.3.1 History

The one of the earliest publication on the law of the sea was *Mare Liberum* (the Free Seas) by Hugo Grotius. It was published in 1609 and established some major concepts in the field. Grotius' viewed the open seas and freedom of the sea as a universal right. He objected to the Spanish and Portuguese exclusive commercial rights in the East

Indies. He worked hard on accurately defined governance (imperium) and ownership (dominium) in law theory. Accordingly the principles in Mare Liberum affirmed that the seas should be free and open to use by all countries. Due to his work, *Mare Liberum*, Grotius is considered the father of law of the sea.

Freedom-of-the-seas Doctrine essentially limiting national rights and jurisdiction over the oceans to a narrow belt of sea surrounding a nation's coastline. The remainder of the seas is proclaimed to be free to all and belonging to none.

"The right of a merchant ship to travel any waters
except territorial waters either in peace or war"

The next development in international law of the sea was *De Dominio Maris* (On the Dominion of the Sea) written 1702. This work by Cornelius Bynkershoek, a Dutchman, explains territorial sovereignty by restricting it to the range of a cannon shot. At the end of the eighteenth century the so called three mile rule became the predominant principle. Sovereignty and jurisdiction over the sea were widely discussed themes in the second half of the eighteenth and during the nineteenth century.

The twentieth century saw the sea used and exploited on a scale never seen in history. There was an increasing pressure from coastal States to extend national claims further offshore, to access the resources. Concerns grow over the amount of fishing occurring and whether it was sustainable. The ability of new larger vessels, to stay at sea for longer periods, meant fish stocks in the open sea where being exploited. The threat of pollution and waste from cargo ships and oil tankers amplified with the increased use of sea routes around world. This pollution threatened not only ocean life, but the coastline of all coastal States.

Conflict began to rise over vessels competing for lucrative fish stocks, pollution spreading and access to the seas for non-coastal States. The Freedom-of-the-seas Doctrine suddenly seemed outdated and needed to be addressed to settle the tensions.

In 1945, United States unilaterally extended its jurisdiction over all natural resources on its continental shelf. This directly challenged the Freedom-of-the-seas Doctrine. Within five years, Argentina, Chile, Peru and Ecuador had asserted sovereign rights over a 200 nautical mile zone. By doing this they hoped they would limit the access of long distance fishing vessels and control the depletion of fish stocks. After the Second World War, Egypt, Ethiopia, Saudi Arabia, Libya, Venezuela extended there claim to a 12 nautical miles territorial sea. Indonesia and the Philippines asserted right over the water separated its 13,000 islands along their archipelagos. Canada asserted rights to the regulate navigation for 100 nautical miles to protect the Artic waters against pollution.

In the late 1960s, discovery of oil in the North Sea led to conflict between Britain, Denmark and Germany, as how to divide the profitable resource. Supertankers ferried oil from the Middle East to European, passing through congested straits and leaving behind a trail of oil spills. The oceans were generating a multitude of claims, counterclaims and sovereignty disputes.

On 1 November 1967 Arvid Pardo, Malta's Ambassador to the United Nations, asked the nations of the world to look around and see the looming conflict. The oceans, the lifeline of man's very survival, were about to be devastated if something was not done.

In his speech to the United Nations General Assembly, he spoke about the superpower rivalry that was spreading to the oceans, of pollution that was poisoning the oceans, conflict over legal claims and of the riches that lay on the seabed. Pardo called for "an effective international regime over the seabed and the ocean floor beyond a clearly defined national jurisdiction". "It is the only alternative by which we can hope to avoid the escalating tension that will be inevitable if the present situation is allowed to continue", he said.

As mentioned earlier, Pardo's speech came at a time when many saw the need for updating the Freedom-of-the-seas Doctrine. This was due to the technological advancements that had altered man's relationship to the oceans. Pardo proposed a new concept, which he called the 'common heritage of mankind'. Defining the common

heritage principle as the ocean space and resources outside the territorial waters of coastal states.

The speech set in motion a process that spanned 15 years. In this time

- The United Nations Seabed Committee was created
- A treaty banning nuclear weapons on the seabed was signed
- The General Assembly adopted a declaration that all resources of the seabed beyond the limits of national jurisdictions are common heritage of mankind

What was initially a plea to better manage the seabed, turned into a global diplomatic effort that rewrote the rules of the oceans. The speech also initiated the factors that led to the convening of the Third United Nations Conference on the Law of the Sea. The purpose was to write a comprehensive treaty for the oceans. The Conference was convened in New York in 1973. It ended nine years later with the adoption in 1982 of a constitution for the seas – the 3rd United Nations Convention on the Law of the Sea (UNCLOS). During those nine years, diplomatic negotiations occurred with representatives of more than 160 sovereign States. The marathon negotiations included bargaining and trading of national rights and obligations, of which the final outcome was the UNCLOS. As the catalyst to this Convention and other subsequent initiatives, Arvid Pardo, is also known as the father of the modern Law of the Sea (Mann Borgese, 1999).

The United Nations Convention on Law of the Sea was adopted in 1982. It came into force on 16 November 1994. This was the first single convention accepted to regulate the use of the oceans. This convention provides a universal legal framework for the management of marine resources and their conservation. Seldom has such change been achieve peacefully by consensus of the world community. Some have called it the most important international achievement since the formation of the United Nations in 1945.

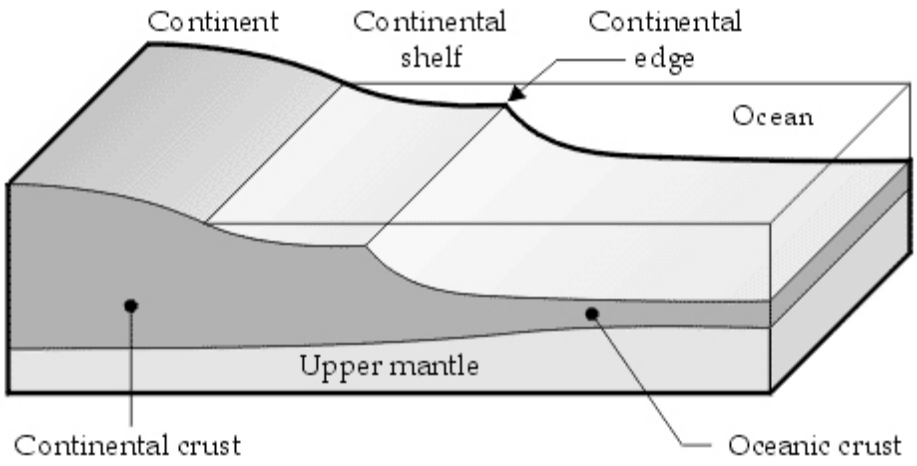
2.3.2 UNCLOS

Through the UNCLOS many institutions, some created by it, are responsible for the governing areas on specific aspects of the ocean under their jurisdiction. However the Convention reminds the central instrument for the promotion of stability and peaceful

use of the oceans. It should not be seen as a static document, rather a dynamic evolving body of law that must be protected and enforced thoroughly for its success. The Convention defines rights and obligations coastal States. However, the United Nations still will continue to play an important role as the primary custodian of the Convention and globally recognised as the forum for monitoring and report on all aspects related to the oceans and law of the sea. There are twelve key provisions that the Convention can be broken down into:

1. Setting Limits
2. Navigation
3. Exclusive Economic Zone (EEZ)
4. Continental Shelf
5. Deep Seabed Mining
6. The Exploitation Regime
7. Technological Prospects
8. The Question of Universal Participation in the Convention
9. Pioneer Investors
10. Protection of the Marine Environment
11. Marine Scientific Research
12. Settlement of Disputes

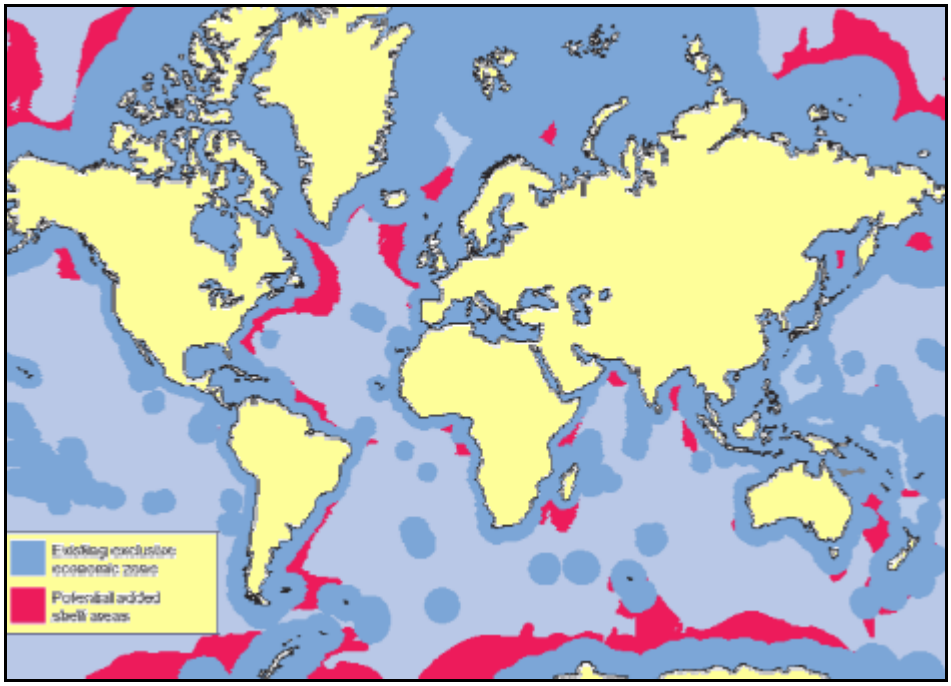
Of particular interest are EEZ and continental shelf, as these directly affect the size of a sovereign States marine territory. The EEZ is the right of a coastal State to exploit, develop, manage and conserve all resources. This includes all living and non-living resources found in the waters, on the ocean floor and in the subsoil of an area extending 200 nautical miles from its shore, if not obstructed by another State. In the Convention some 38 million square nautical miles of ocean space was divided up between the coastal States. As a result 86 coastal States have economic jurisdiction up to the 200-mile limit. Almost 99 per cent of the world's fisheries now fall under some nation's jurisdiction. Also, a large percentage of world oil and gas production is offshore. Many other marine resources also fall within coastal State control.



Every continental land mass on the Earth has a common undersea geological feature. All are completely surrounded by a sharp edge known as the "Continental Shelf". Not visible from the land, these cliff structures mark the place where present day continents broke away from the original mass of the assumed supercontinent "Pangaea". (PPL 2004)

Figure 2.1 – Continental shelf definition

By setting the EEZ limit at 200 nautical miles, the Convention resolved many claims, disputes and interpretation about the boundary of the continental shelf for seabed and subsoil exploitation, particularly with geographically disadvantaged States. However it also addressed about 30 States, whose continental shelves extended further than 200 nautical miles. In these cases, the States could extend there jurisdiction up to 350 nautical miles from the baseline or 2,500 metre depth. However these rights would not affect the legal status of the water or that of the airspace above the continental shelf. To gain this extension, States would have to submit claims to the Commission on the Limits of the Continental Shelf. It is important to note that a time limit of ten years is imposed on submissions, from the Convention comes into effect for that State.



(Monahan 2003)

Figure 2.2 – One version of the new world map

2.4 Conclusion

History of the law of the sea is old. It has seen many disputes over the years, usually because of countries unilaterally staking claims. However the creation of the 3rd United Nations Convention of Law of the Sea, is the first international recognised set of rules, laws and regulations of the sea. Through UNCLOS and its institutes, it regulates all uses of the sea and should always be referred to as the ultimate framework for all nations when using the marine environment.

Since the first United Nations Human Environment in 1972, many achievements have been made in regards to agreement of how to better manage the health of the Earth. However the success of the talk and agreements has not yet resulted in significant progress in slowing of harmful development patterns and the achievement of sustainable practices. The new challenge is to implement successful, Agenda 21 and other such agreements, particularly by governments at national and local levels.

3 MARINE ADMINISTRATION SYSTEMS

The intension of this Chapter is to analyse case studies that will help look at how countries are addressing and implementing international agreements like Agenda 21 and UNCLOS. United States, Canada, Australia will be studied to look at their approach, rationale and progress in developing new ways to better manage the marine environment. In addition research in New Zealand and the Netherlands will be considered, exploring important issues and concepts identified. Finally initiatives from international collaboration, International Federation of Surveyors and Permanent Committee on GIS Infrastructure for Asia and the Pacific, will be reviewed.

3.1 Introduction

The marine environment is a large, complex system with many overlapping and conflicting interests, agencies, processes and legislation (Williams, 1999). To merely use land based principles in the marine environment, is a simplistic approach that suffers some major flaws (Collier, Leahy et al. 2001). The marine environment presents many unique problems that current terrestrial system would fail to solve. Some such problems are:

- The concept of tenure does not exist at sea
- It is not possible to use classical means of boundary demarcation offshore
- Three dimensional aspect, four dimensional in come cases
- Common for multiple overlapping rights

(Collier, Leahy et al. 2001)

The rest of this Chapter will look at how countries and organisations have addressed these unique problems.

3.2 United States

The United States and its insular areas, such as Puerto Rico, Virgin Islands, American Samoa, Guam, have more than 13,000 miles of coastline. The offshore EEZ totals almost 3.4 million square miles. U.S. fisheries accounted for 6% of total world commercial fishery landings in 1989. Approximately 17 million U.S. marine recreational fishermen made 40 million fishing trips in the Atlantic and Gulf of Mexico coastal areas alone. In 1989, 305 billion barrels of crude oil and 4200 billion

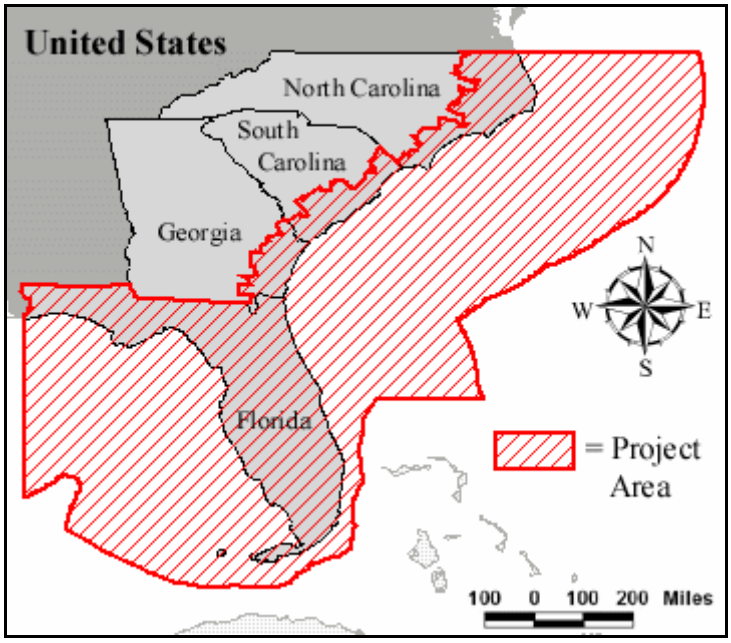
cubic feet of gas were produced offshore. The U.S. coast guard investigated oil spills totalling an estimated 338,000 barrels of oil from vessel and non-vessel sources.

In the U.S., coastal states have control of the sea floor and marine resources from mean high water mark out to the state's seaward boundary, generally 3nm. However the existing regimes of ocean governance and management in the US has been described as "ill-equipped to address the inevitable conflicts and problems" and the system was "fragmented, complex and thus poorly understood" (Neely, 1998).

The US response to a coordinated holistic ocean management was through the Coastal Services Center (CSC), an office within National Oceanic and Atmospheric Administration (NOAA). The mission of NOAA CSC is 'to support the environmental, social, and economic well being of the coast by linking people, information, and technology'. This is achieved through serving the state and local coastal government agencies, non-government and non-profit organisations with resource management programs. Since its establishment in 1994, the Center has been a part of over 100 ongoing projects focused towards resolving coastal issues. One such program is Ocean Planning Information System (OPIS). OPIS is an ongoing project that provides marine resource managers with timely and convenient access to downloadable data, cutting-edge online mapping functionality, and guidance on how to use geographic information systems (GIS) in a meaningful way with respect to ocean management (CSC NOAA, 1998).

OPIS is a prototype holistic marine management system that provides access to geo-referenced spatial data and legal information. The prototype covers the south eastern US States (North Carolina, South Carolina, Georgia and Florida), extending from the coastline to the US exclusive economic zone. Major features of the product include:

- an interactive mapping application
- marine and coastal spatial data
- data and metadata download tools
- legislative summary pages



(NOAA 2001)

Figure 3.1 – OPIS study area

In 1995, a working group comprising 5 government agencies (2 State and 3 federal) initiated a series of meetings to discuss the development of a regional marine GIS. Such a tool was seen to be benefiting the marine environment by addressing effective and coordinated management. The working group identified high priority issues and data sets that would need to achieve the goals. Some of the key issues were:

- Protection of critical habitat
- Better understanding of conflicts associated with uses of ocean resources and the relative economic value of those use
- Identification of environmentally safe sand resources for beach renourishing
- Sustaining local fisheries
- Better mitigating potential damages from natural and man-made hazards

The working group recognised a need to educate policy makers and the general public about all associated marine management issues. Consequently they believed an online marine GIS would achieve this.

In February 1998, CSC started developing the OPIS website. The development of OPIS used government agencies as project partners, a working group comprising a further 16 agencies and additional data and expertise from 9 other agencies. In

September 1999, the OPIS website went live, providing free access to all users to regional spatial data. In addition the site provided educational information of marine issues and an overview of ocean governance and management. In 2001, the OPIS project received a Hammer Award, a vice-presidential acknowledgement of projects that help government operate more effectively and efficiently.

In 1999, James Good and Derek Sower, produced a final report on the CSC OPIS project, entitled *Benefits of Geographic Information Systems for State and Regional Ocean Management.* The report critically examined the project and dealt with an overarching question; *can GIS via the Internet improve access to ocean data and information, increase efficiency and effectiveness in decision making and thereby foster more integrated ocean management?* (Good, 1999). The report came up with seven principle findings and six recommendations.

One of these principle finds was the GIS benefits to ocean management. The report found that potential benefits were "deep and widespread" and could assist all sectors, private and public, in the use, management and governance of the marine environment.

In a key paper published in the International Journal on Computers, Environment & Urban Systems (Special Issues: Cadastral Systems) entitled *Building A Marine Cadastral Information System For The United States – A Case Study*, the concept of a marine cadastre in U.S. is explored. The authors, Fowler and Trent, compare and contrast how land cadastral principles might be applied to the marine environment. They critically analyse the NOAA OPIS project, looking at how the project is achieving integrated marine management. They see a land cadastre as a government entity of geo-referencing legal descriptions of property rights. It is acknowledged that integrated thousands of propter right is similar to 'putting together a massive jigsaw puzzle', however once accomplished they believe:

> *The ability to visualise property rights, regulations, laws, and management regimes can assist policy makers in understanding conflicts, revealing inconsistencies in national or state policy, educating or justifying boundary limits to the public, and providing a general organising structure to very complex data.*
>
> (Flower et al, 2000)

This hypothesis is what OPIS was developed and designed to test in the marine environment. Finally, although OPIS was specific to the southeast region of the US, the principles and methodologies were always designed to be applied on a national scale. According a number of projects have already been developed using its principles.

3.3 Canada

Canada has the world's longest coastline, approximately 240,000km including major island coastlines and over 50,000 islands. Canada's EEZ is equivalent to over 30 per cent of Canada's total landmass. About 7 million Canadians live in coastal communities, where many depend on the coast and the sea to make a living. Canada's indigenous people have always used the sea as a source of food. In 1994, the total marine fish catch was about 73 million tonnes.

In 2000, a team of seven researchers from four universities (University of New Brunswick, Memorial University, University of Ottawa, and University of Victoria), submitted a successful proposal to the Geomatics for Informed Decisions (GEOIDE). GEOIDE is a federal funded network of Centres of Excellence. The 'network of network' brings together the skills, technology and people from all areas of the community (public, private and corporate) to develop Canada's competences in the field of Geomatics. The successful submission was entitled Good Governance of Canada's Oceans. Deliverables of the project include demonstrations of how geomatics technologies can be used by decision makers to identify the socio-economic, legal, and environmental impact of boundary uncertainties, evaluate boundary alternatives, and resolve the issues (GEIODE, 2000).

The objectives of the project were:

1. To Identify and Evaluate Boundary Information Requirements for Good Ocean Governance
2. To Investigate Spatial Data Uncertainty and Its Impact on Data Integration and Boundary Delimitation
3. To Develop and Enhance Prototype Visualization Tools for Marine Boundary Delimitation

4. To communicate the results of the research to decision-makers through a series of national workshops

To achieve the objectives, three case study sites were created: New Brunswick, Bay of Fundy and a portion of the Atlantic extended continental shelf. The case studies set out to examine issues about provincial and county marine boundary components, a proposed marine protected area and continental shelf boundaries.

Few countries have well defined and precisely delimited marine boundaries, while there are common issues (section 3.1), most States also have their own unique situation. Canada's unique problems include:

- Multiple and unclear jurisdictional boundaries, especially on the Atlantic Coast (e.g., federal- provincial and inter-provincial limits: continental shelf limit);
- Co-management arrangements for fisheries and oil and gas production
- Lack of a single agency or focal point for managing offshore rights and boundaries and therefore information about those boundaries and rights
- Resulting complexity of the data integration issues (including scale, precision, reliability, completeness, datums, currency)
- Increasing role of as yet ill-defined community and aboriginal rights offshore
- The extremely large size of the area under consideration and therefore the high cost of collecting data using traditional means

(Nichols and Monahan 1999)

The project focused on one subset of framework data in a national-wide marine geo-spatial data infrastructure (MGDI) being:

- Boundaries and limits of jurisdiction e.g.,(federal, provincial, inter-agency, county, international)
- Boundaries of property interests (commercial and non-commercial, private and public rights, common/community property rights, aboriginal rights).

As the project aimed to demonstrate the importance and capabilities of marine geomatics technologies, the project used existing leading-edge technology (e.g., CARIS LOTS, SPATIAL FUSION, and ocean mapping visualization techniques).

While the technologies were not the focus, an important part was collaborating with industry partners.

Doug Culham, Deputy Surveyor General (East) opening remarks speaking on 'The Need for Coordination' a workshop organised by the project said, '*We are here to talk about property rights in the offshore and the infrastructure required to support the various property systems'*.

The project outlined three key questions that should be answerable for a State to provide 'good ocean governance'. These questions should not only be answered, but the answers should be 'complete, clear, and easily communicated'. The three questions where:

1. What resources, living and non-living, are there to govern?
2. Who holds the rights and responsibilities for their safe and orderly conservation, distribution, and exploitation?
3. What are the spatial limits (boundaries) of those rights and responsibilities?

The GEIODE funded project focussed on the last question, however this was viewed as part of the larger marine initiative. That is, the development of a MGDI. It was further pointed out that this layer of spatial limited provides geo-referenced information on legal rights and responsibilities. Without this fundamental data and despites its importance, Canada like many countries, does not have this 'comprehensive inventory of these rights and boundaries' (GEIODE, 2000).

3.4 Australia

Australia has the third largest marine territory in the world. Despites it relative isolation Australia shares maritime borders with Indonesia, Papua New Guinea, Solomon Islands, New Zealand and France. Australia is responsible for 11 million square kilometres of ocean within its EEZ. Annual exports of marine products are valued at $1.1 billion in 1992–3. Sixty aquatic creatures from seaweed to crocodiles are now farmed worth $260 million in 1991–92. However one of the largest gains from Australia's oceans is tourism. For example, the Victorian penguin parade tourism is worth $50 million per year to that States economy. Socially Australians gain from there ocean territories. Three quarters of Australians live within 50

kilometres of the coast. Australians eat an average of 12 kg of seafood per year. One in every three Australians goes fishing. Each year 1.9 million scuba dives take place in Australian waters. Over 6000 shipwrecks have occurred in Australian water over the last 400 years. Australia has all five of the world's temperature zones: tropical, subtropical, temperate, subpolar and polar. Australia has more than 300 marine protected areas, which cover an area more than 463,000 square kilometres or 5% of Australian waters. Australia has the largest area of temperate seagrass and one of the largest areas of tropical seagrass in the world. Australia has one of the most diverse ranges of fish in the world. Australia's waters are home to more than 4000 species of fish including 166 species of shark and more than 110 species of seahorse. Some 200 different species of fish, 60 species of crustaceans and 30 species of molluscs are fished.

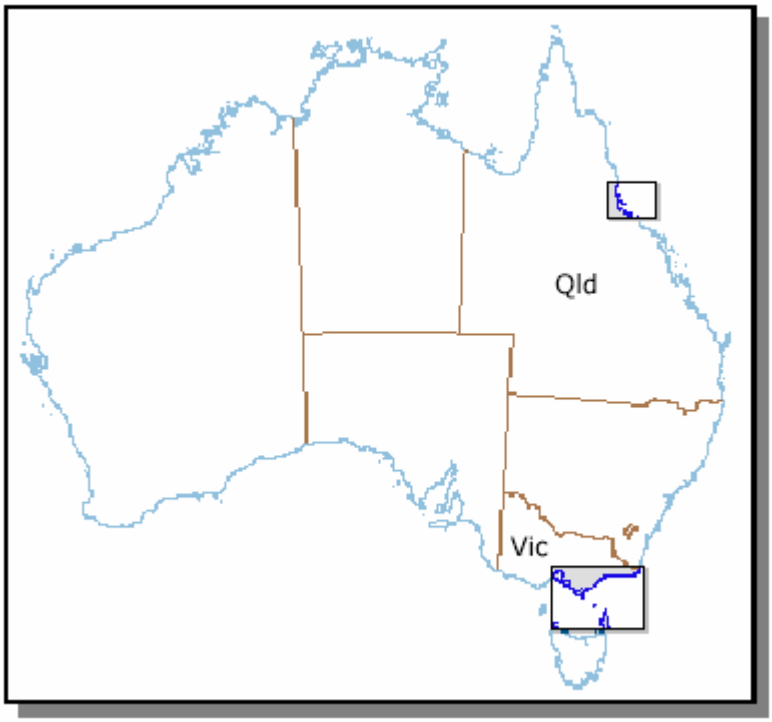
In 2001, a two year Australian Research Council (ARC) grant was awarded for a project investigating marine SDI and cadastre in Australia. The project involved three State government agencies, and The University of Melbourne. The principle objectives of the project were defining issues that were hindering development of a marine cadastre in Australia and establishment of an approach for future research. To achieve these objectives the research was divided into two focus areas; an examination of existing land administration and Australian Spatial Data Infrastructure (ASDI) principles and how they might be extended to the marine environment, and the concept of defining a three-dimensional and four-dimensional parcel, its boundary uncertainty and integrity in a marine multi-dimensional cadastre.

The project included running workshops, conducting a national questionnaire and industry consultation. All information gathered was used to identify fundamental design criteria for an Australian marine cadastre. A pilot project, with two case study areas (*Figure 3.2 – Australian pilot project locations*) was used to test the findings and hypothesis. Also the Australian Marine Cadastre concept, has been summarised in an interactive diagram (*Figure 8.2 – Screen shot of Australian* Marine Cadastre diagram*).*

A second ARC grant, was awarded in 2004, and has continued the project going beyond the initial two years. This second project aims to allow independent

collaborative research, building upon the findings and results already accomplished. Consequently using the body of knowledge and expertise, the second project will address four key problems.

1. Resolving issues in the definition of the tidal interface
2. The use of natural rather than artificial boundaries in a marine cadastre
3. Extension and application of the ASDI to support a marine dimension
4. Marine policy, legal and security issues and the marine cadastre



(Fraser, Todd et al. 2003)

Figure 3.2 – Australian pilot project locations

It can be seen, not only by the fact that Australia is surrounded by oceans but also because of the diverse benefits it gains, that ocean management is critical to Australia maximising its returns from the ocean in a sustainable manner. The objective of the ARC funded project of developing a marine cadastre was to 'provide a comprehensive spatial data infrastructure whereby rights restrictions and responsibilities in the marine environment can be assessed, administrated and managed'.

To achieve this objective, it was acknowledged that first there was a need to identify and understand:

1. The role and impact of various levels of legislation and regulation
2. The rights, restrictions, responsibilities and requirements of the various players
3. The source and quality of data to be used in the spatial analysis and management

(Collier, Leahy et al. 2001)

Once the knowledge base was built up, then the design, development and creation of a marine cadastre to proceed.

3.5 Others

While United States, Canada and Australia are not the only countries with marine management initiatives, they differently are leading the way in defining and creating holistic marine management systems. However, New Zealand and Netherlands have added significant works to the international efforts as well as regional and global initiatives by FIG and PCGIAP.

3.5.1 New Zealand

New Zealand, placed in the south-west Pacific Ocean, consists of two main, and several smaller islands with a combined land area of 270,500 square kilometres. The marine area within New Zealand's EEZ is around 15 times the size of our land area – the fourth largest exclusive economic zone in the world. In a report by Dr Morgan Williams, Parliamentary Commissioner for the Environment, entitled *Setting course for a sustainable future; the management of New Zealand's marine environment*, key issues and concerns were identified as to how New Zealand manages it marine environment. Key issues the report addressed were:

- Why the marine environment matters to New Zealanders. This discussion covers the different values and expectations that people bring to their involvement with the sea, and the utilisation and monetary value of marine resources.
- How the marine environment is managed, including an outline of the statutory and institutional framework that applies to marine management (a rather bewildering system with 18 main statutes and 14 agencies having some

responsibility for management). Also explored is the relationship between government and community in marine management.

- The different rights and responsibilities that people have, or expect to have, in the marine environment
- The adequacy of our information and knowledge about the marine environment.

While being constructive, the report also identified a number of areas of concern, which needed to be addressed before sustainable marine environment management system could be achieved.

- There is a lack of communication and a grave lack of trust among marine stakeholders that is severely inhibiting the advancement of sustainable management.
- New Zealand's lack of marine knowledge is a serious environmental and economic risk, and the willingness of Government to invest in attaining knowledge is crucial to achieving sustainable management.
- Current marine management structures are arbitrary, fragmented, and lacking a coherent overarching strategic focus that would integrate diverse interests and values.
- The current commercial fishing rights regime cannot by itself ensure sustainable management of fisheries and other marine resources.

On the academic side in 1998, a paper prepare by Chris Hoogsteden for the FIG XXI International Congress: Commission 7 (Cadastre and Land Management), explores issues in a New Zealand context. The paper analyse the New Zealand situation of marine management and identifies the need, benefits and challenges ahead. Hoogsteden recommendations and approach is focused around the formation, or rather an extension and application of terrestrial cadastre principles to the marine environment. *"If it is accepted that a legal cadastre is a very efficient method of identifying, recording and protecting all interests in "land" in a state, then the extension and evolution of the land-based cadastre to the maritime environment is not only sensible but necessary for commercial progress."(Hoogsteden 1998)*

Under opportunities and challenges he lists five key areas: Tenure, Title and Registration, Boundaries, Survey and Control, Resource Management Consents and Administration. The paper continues and suggests three models for implementation of a 'on land – off shore' cadastre: incremental, sectoral and seamless models.

Finally from the Office of the Surveyor-General in New Zealand, a technical report, 'Principles for a Seabed Cadastre' was released in June 1999. The report defines seven key principles needed for the creation of a marine cadastre: design, spatial extent, land-sea boundary, boundary point definition, boundary lines, geodetic datums and regulatory environment. Interestingly the report does not refer to the system as a marine cadastre, rather a 'seabed' cadastre. This approach is different from United States, Canada and Australia. In line with Hoogsteden's concept of a 'seamless' cadastre, the marine environment is not addressed as a separate space, rather a continuation of the land.

The report defines the seabed cadastre as:

> *A system to enable the boundaries of seabed rights and interests, to be recorded, spatially managed and physically defined in relationship to the boundaries of other neighbouring or underlying rights and interests.*

While the rights and interest are referred to as 'boundaries of the seabed', it is important to note that it is not excluding rights to the water column and surface (eg. fishing and transport). Instead the cadastre system would be three dimensional, but all rights would be tied or associated with the part of the seabed that they are above.

3.5.2 Netherlands

In Paris 2003, during a FIG Working week, a paper was presented by Michael Barry, analysing the situation in The Netherlands. Unlike previous cases, this case study has a much more complex political and historical context. The Netherlands territorial seas, are part of the North Sea, is one of the most heavily used and divide seas in the world. Eight countries have sovereign coastline around the North Sea with a further four, are part of the North Sea catchment. Barry points out that due to this complex political atmosphere, "it is necessary to debate policies, management strategies, laws, permits and other similar instruments at regular intervals at international, ministerial and operational level to achieve an integrated system of cooperative governance". It is pointed out that institutions such as the Committee of North Sea Senior Officials

(CONSSO) a regional body and Interdepartmental Deliberations Over North Sea governance (IDON) an national body, are integral to the successful long term governance and management.

IDON has been in place for about 25 years, known as Interdepartmental Coordinating Committee for North Sea Affairs (ICONA) until 1998. This is the primary institution in terms of coordination of governance and policy formulation at a national level. As can be seeing in Figure 3.3 – IDON, it contains a number of government agencies from six different Ministries; this highlights the diversity and the complexity of uses in the marine environment.

(Barry, Elema et al. 2002)

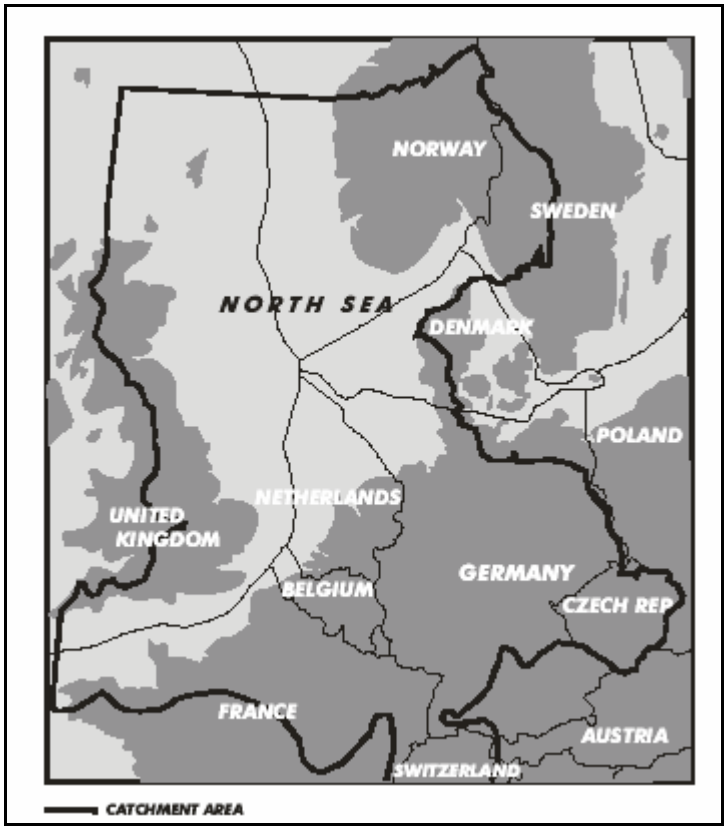
Figure 3.3 – IDON

At a regional level certain policies and regulations relating to the North Sea are determined internationally. These issues include positions of international boundaries, fishing practices and quotas, shipping traffic management and management of the natural environment.

The tension between economic interest and environment conservation seem inherent thus creating the need for proper management. As all stakeholders have different objectives, the challenge is to strive towards compromise and harmony. Barry further

points out, the ‘democratic culture’ of the North Sea give confidences to the future management of the region. The paper recognises that the land and see should not be separated and that the entire North Sea catchment area should be considered when managing the North Sea marine environment.

The Netherlands as a case study brings a new dimension, which has not been seen in the previous cases – regional management and cooperation. This case has highlighted a different approach with regional bodies making polices. Consequently, management of the marine environment is done with environment boundaries rather than political.



(Barry, Elema et al. 2002)

Figure 3.4 – North Sea catchment area and political boundaries

3.5.3 International Federation of Surveyors

Fédération Internationale des Géomètres (FIG) is a federation of national associations and was founded in 1878. More than 100 countries are represented in FIG. A UN recognised NGO, the federation is the only international body that represents all surveying disciplines. Its aim is ‘to ensure that the disciplines of surveying and all who practise them meet the needs of the markets and communities that they serve’.

These aims are achieved through promoting practices and professional standards of the profession.

The work that FIG does is coordinated and divided into ten areas with associated commissions. Each commission prepares and conduct programmes, reporting to the FIG international congresses. This is held every four years with annual working weeks held every other year. FIG Commissions:

Commission 1 - Professional Practice
Commission 2 - Professional Education
Commission 3 - Spatial Information Management
Commission 4 - Hydrography
Commission 5 - Positioning and Measurement
Commission 6 - Engineering Surveys
Commission 7 - Cadastre and Land Management
Commission 8 - Spatial Planning and Development
Commission 9 - Valuation and the Management of Real Estate
Commission 10 - Construction Economics and Management

A recent initiative by FIG was to investigate ‘cadastral reforms and to develop a vision how cadastral systems would look like in about 20 years to be able to better satisfy the needs of the steadily developing humankind’. The result was the publication of 'Cadastre 2014 - A Vision for Future Cadastral Systems' at the XXI FIG Congress in 1998.

The publication says that cadastral systems in the future will have to adapt with the development of legislation in their countries. It identifies that societies are regulating natural resources with sustainable development in mind through pubic law. As a result, juridical arrangements need to define rights and restrictions of land. The brochure uses Professor Jo Henssen definitions of land, cadastre, land registration, and land recording, given at the Delft seminar 1995. However, it acknowledges that for future cadastral systems, these definitions must be enlarged to some extent. Interestingly Henssen's definition for land does include the marine environment, if only barely.

Land is defined as an area of the surface of the earth together with the water, soil, rocks, minerals and hydrocarbons beneath or upon it and the air above it. It embraces all things which are related to a fixed area or point of the surface of the earth, including the areas covered by water, including the sea.

Despite this definition including the marine environment, most land cadastre finish at the high water mark. However Cadastre 2014 recognises that the definition is expected to change. With this recognition, has come investigations into the area by FIG. In Paris during the 2003 Working Week, a technical seminar (TS20) under the heading of New Professional task was entitled Marine Cadastre and Coastal Management. In Athens 2004, as Hydro workshop (WSH2) looked at Marine Cadastre issues. Finally April this year in Cairo, technical seminar (TS40) reported on the activities of Commission 4 working groups, which include two sections on Marine Cadastres.

There was also a University of New Brunswick – FIG conference on marine cadastre issues held in 2003. This was part of the research discussed in Section 3.2. The conference set to address the following questions.

- What is the scope of a Marine Cadastre?
- How does it relate to a Spatial Data Infrastructure?
- What are the priority issues that need to be addressed?
- What organizational arrangements that might be developed to push the concept forward (internationally, regionally, and nationally)?
- How can other disciplines and stakeholders be engaged?

3.5.4 Permanent Committee on GIS Infrastructure for Asia and the Pacific

During the 13th United Nations Regional Cartographic Conference for Asia and Pacific (UNRCC-AP), Beijing 1994, the Permanent Committee on GIS Infrastructure for Asia and the Pacific (PCGIAP) was established. The Committee comprises 55 member countries from the Asia-Pacific region. Under Article 3 of its Statutes, the organisation aims to maximize the economic, social and environmental benefits of geographic information in accordance with Agenda 21 by providing a forum for nations from Asia and the Pacific to:

a. cooperate in the development of a regional geographic information infrastructure;
b. contribute to the development of the global geographic information infrastructure;
c. share experiences and consult on matters of common interest; and
d. participate in any other form of activity such as education, training, and technology transfer.

At the 16th UNRCC-AP in Japan 2003, it was decide that PCGIAP working group 3 (cadastre), the develop a marine administration template project. The idea was based on the Cadastral Template site (www.cadastraltemplate.org). The project, "Country Comparison of Marine Administration Systems" has been developed by the Centre for Spatial Data Infrastructures and Land Administration at the Department of Geomatics, the University of Melbourne.

3.6 Conclusion

From the review of the developments around the world of such systems, it is clear that all are unique. While the approach a country takes varies, so to does its outcome. This is due to social, political, historical and physical composition of a countries marine environment. Consequently, it is clear that no one model will be developed for all countries. Rather similarities should use to create a general framework, but each will have their own unique solution.

4 DENMARK'S MARINE ENVIRONMENT

The intension of this Chapter is to examine the current management regime for Denmark's marine environment. It will start by giving a description of the physical environment and historical context of management. Then it will review the current management structure within the government as well as specific key government organisations.

4.1 Description

Denmark has a coastline of approximately 7,300 km and marine territory of about 105,000 km² (FAO 2004). The coastlines are generally formed in sandy glacial plains or moraine cliffs. In a few locations bordering on the Baltic Sea tertiary chalk formations protrude the glacial landscape where headlands are formed. While the course of the coastline in general determined by the surface forms of the glacial or pre-glacial deposits, the coasts have been and still are continuously changing by marine erosion and deposition. Flat shores are the most common types of shore profile in Denmark. Although coastal dunes are very common in Denmark, they cover less than 700 km² or 1.6% of the total land area.

Denmark's landscape was shaped by the last Ice Age, ending about 10,000 years ago. In Scandinavia, only the western parts of Jutland were ice-free during the glaciation and a large part of what is today the North Sea was dry land connecting Jutland with Britain. The Baltic Sea with its unique brackish water is a result of the melted water from the Weichsel glaciation being combined with the saltwater of the North Sea when the straits between Sweden and Denmark opened about 7,000 years ago.

Most of the coastal dunes are found on the West Coast of Jutland where they form a belt up to 10 km wide from Skallingen in the south to Skagen in the north. The North Sea coast of Denmark is sandy and particularly vulnerable to erosion. Mean erosion rates reach values up to 2 m per year and littoral drift is in the order of 100,000 - 1,000,000 m^3 per year. The Kattegat and Baltic Sea Coast are moderately exposed with mean erosion rates of 0.3 - 0.5 m per year and the littoral drift is up to 75,000 m^3 per year.

4.2 History

The sovereign State has always held ownership of all Danish waters and consequently has a long history of administration of its marine territories and environment. In 1560 the Royal Danish Lighthouse Authority was established and in 1567 King Frederik II introduced the term ‘maritime law’ for the first time. In 1683, King Christian V introduced into Danish Law a new regulation that governed the employment and pay of seafarers (DMA 2005).

In 1784 the Royal Danish Hydrographical Department was established. In 1831 the Royal Danish Pilotage Authority was established, in 1844 the Royal Danish Buoy Service was established and in 1852 the Rescue Service was established. In 1920, the official ‘Danish Government Ships Inspection’ was founded. In 1971 Denmark became the first country in the world to establish a ministry for the environment.

While initially the management of the marine environment was primarily focused on shipping, nowadays there are government organisations to manage and regulate all sectors of the marine environment including fishing, environment protect and conservation, oil and gas exploration, shipping and transport, infrastructure, etc. While there is a long history of governing the seas, structures seem to have been created on a needs bases. Also often organisations have merged and been restructured. For example, in 1973 when four organisations united (Royal Danish Hydrographic Department, Royal Danish Pilotage Authority, Rescue Service, and Lights and Buoys Service) to form the Royal Danish Administration of Navigation and Hydrology.

4.3 Management

The Ministry of Environment is responsible for integrated management and sustainable development in coastal and marine areas including Denmark’s EEZ. The EPA together with the Ministry of Defence, are responsible for protecting the Danish coast against oil and chemical pollution. The Ministry of Environment and the Ministry of Trade and Industry are cooperating to develop sustainable tourism. The Danish Coastal Authority is institution under the Ministry of Transport and Energy and responsible for capital works and dredging to protect the coastal zone. The Danish Maritime Authority is responsible for the registration of all Danish vessels as well as vessels with Danish territorial waters. The Danish Energy Authority is responsible for

the issuing of exploration mining license of oil as gas. The authority is also manages wind farms. Consequently management is very much sector based, with horizontal integration on a needs or 'ad-hoc' bases. In accordance with national legislation, the general public is involved in the planning process and The Danish Society for the Conservation of Nature (an NGO) has a statutory right to complain under the majority of Acts concerning nature and the environment.

The counties are responsible for the setting up of regional guidelines for development in the coastal zone, including indications of in which areas development and construction can take place. They are also responsible for environmental quality to a depth of 6m or at least 1 nm from the shoreline. To summarise, there are eight key government agencies which together share the responsibility of management of the Denmark's marine environment. These eight agencies are spread across five different ministries. See Figure 9 for there structure.

4.4 Government organisations

This selection aims to review the roles and responsibilities of the eight key government organisations identified in the previous section.

4.4.1 Danish Coastal Authority (Kystdirektoratet)

The Danish Coastal Authority (DCA) was established in 1973 and is currently under the Ministry of Transport and Energy. The Coastal Authority is primarily concerned with the protection of the Danish coastline through the construction of infrastructure. It jurisdiction extends to the limits of the Danish territorial seas (12 mn). It attends to the public's interest in harbour, constructions, coastal protection and constructions. The Coastal Authority has special focus on the West Coast and the Wadden Sea.

The Danish coastline over the years has been exposed to numerous storm surges. The Thyborøn isthmus was breached in a gale in 1862, the damage prompted the establishment of the Royal Danish Department of Maritime Works in 1868. Since then the Danish government has initiated large scale works primarily along the West Coast (between Bovbjerg and Thyborøn) to prevent drastic coastal erosion and flooding. The worst in modern times was in 1981. Since then works have been completed to reinforce dykes and harbours as well as the establishment of a surge warning and alert system for the evaluation of the population in critical situations.

The Coastal Authority works closely with coastal counties and local municipalities. An example of this cooperation is in the County of Ringkjøbing, there is a Joint Agreements (entitled “to preserve and to prioritise”) between five local municipalities. This agreement is include the scope and distribution of expenses for coastal protection, which is approximately DKK 100 million annually.

In addition to its coastal responsibilities the Coastal Authority, is also responsible for approving all telecommunication cables and platforms (excluding oil and gas). It also responsible for the National Dredging Service and coastal nourishment programs. In completing its task it will primarily interact with the Forest and Nature Agency, Environmental Protect Agency and the Royal Danish Administration for Navigation and Hydrology.

4.4.2 Danish Energy Authority (Energistyrelsen)

The Danish Energy Authority (DEA) was established in 1976 and is currently under the Ministry of Transport and Energy. The authority carries out all task related to the production, supply and consumption of energy including gas, oil and electricity. It has to ensure security of supply and has the responsibility of developing energy in respect to the economy, the environment and security.

Since 1997, Denmark became self-sufficient in the production of oil and gas. The DEA administrates and supervisors the Subsoil Act which relates to recovery and storage of oil and gas, salt production and geothermal energy. The DEA also administrates provisions of the Offshore Installations Act, the Pipelines Act and the Act on the Continental Shelf. These Acts have a lot to do with occupational health and safety as well as environment protection connected with offshore oil and gas production. With respect to the marine environment the primary responsibilities include the oil and gas fields in the North Sea, wind farms and the associated submerged cables pipelines.

The DEA cooperates with corresponding authorities in other countries around the North Sea, participates in regulatory work with the EU as well as other Danish government departments. Within the EU there is particular focus on implementing the

joint regulations for the internal energy market for electricity and natural gas and drawing up common rules concerning renewable energy and energy efficiency. Denmark supports this goal as well as the full liberalisation of the electricity and gas markets.

The DEA participates in international cooperation in a number of fields concerning health, safety and environmental issues at offshore installations.

- North Sea Offshore Authorities Forum (NSAOF)
- Offshore Mechanical Handling Equipment Committee (OMHEC)
- Bilaterally with Norwegian and British Authorities
- Oslo-Paris Commission (OSPAR)
- EU (Advisory Committee on Safety and Health at Work)
- EU (Standing Working Party for Mining and Other Extractive Industries)

As mentioned above DEA interacts with many other organisations. However with in the Danish government the primary bodies it deals with are the Environment Protection Agency and Forest and Nature Agency, primarily to do with environment impact assessment with new developments and regulations.

4.4.3 Danish Environment Protection Agency (Miljøstyrelsen)

The Danish Environmental Protection Agency (EPA) is charged with the responsibility of preventing and combating water, soil and air pollution. The EPA is part of the Ministry of Environment. It is concerned with the protection of both flora and fauna from threats of all types of pollution.

The EPA Water division is responsible for task in the areas of the EU Water Framework Directive, groundwater protection, water supply, wastewater, marine environment, management of dredged materials, offshore, and reference centre for point sources.

The Danish EPA is responsible for the marine environment, i.e. water quality and assessment of biological conditions, marine fish farms, dredging, and administration of the Marine Environment Act. Regulation of ship-based pollution and off-shore activities is also administered by the agency.

Many parts of East and Central Europe flow into either the North Sea or the Baltic Sea, with their content of nutrients and other environmentally harmful substances. EPA set ambitious goals in close collaboration with its neighbouring countries and sister agencies. These collaborations will be discussed further in Chapter 6.

4.4.4 Danish Forest and Nature Agency (Skov og Naturstyrelsen)

Under the Ministry of Environment, the Danish Forest and Nature Agency consists of 17 divisions and 25 states forest districts. Danish Forest and Nature Agency works to promote sustainability in the administration of Denmark's natural and historical heritage in a balance between use and protection. In the marine environment the Forest and Nature Agency is concerned with raw materials and nature conservation both flora and fauna.

With respect to the sea and habitats the agency maintains the following agreements and areas.

- The Directive on the Conservation of Wild Birds
- EEC Habitats Directive
- Ramsar Convention on Wetlands
- Bern Convention on the Conservation of European Wildlife and Natural Habitats
- The EU marine strategy
- International marine conventions.
- The Wadden Sea.
- Assessment of marine EIAs
- Marine activities such as fixed links, high speed ferries, wind farms, dumping of dredged materials, cables and pipelines.
- Nature monitoring.
- Coordination of research.
- Contact to the European Environment Agency.

The Spatial Planning Department is also part of the Forest and Nature Agency. The Spatial Planning Department administers the Planning Act in close cooperation with Denmark's 14 counties and 275 municipalities and serves as the national authority for

spatial planning. Spatial planning establishes a framework for land use and the construction of buildings, roads and other infrastructure, including how existing urban features and landscapes can best be protected. Tasks related to environmental protection are increasingly integrated in the work of spatial planning. Spatial planning in Denmark is carried out at three levels: local and municipal planning in the municipalities, regional planning in the counties and national planning coordinated by the Ministry of the Environment.

The main government body the agency works with is the EPA. However it is a complicated web of communication as both agencies deal with local governments, but also international organisations like UN and IMO. However when dealing with other countries and international organisation, the Danish Foreign Affairs Ministry is involved to coordinate uniform policy.

4.4.5 Danish Maritime Authority (Søfartsstyrelsen)

The Danish Maritime Authority (DMA) was founded in 1988 by merging the six Danish shipping authorities that existed at that time. The authority's mission is 'to promote health and safety on clean seas and to effectively strengthen the competitiveness and employment of maritime industries'.

The authority is concerned with safe shipping and navigation. All Danish vessels must be registered with the DMA and comply with their regulations. The DMA has authority for everything within a ship from the specifications of the hull to the number of safety jackets. It has jurisdiction of Danish vessels as well as vessels in Danish territorial waters.

The Danish merchant fleet consists of approximately 500 larger commercial ships engaged on international voyages, 5,000 fishing vessels, and 2,000 other vessels. Being a nation surrounded by water, Denmark can also add to its collected fleet approximately 50,000 pleasure craft. Primary authority the DMA interacts with is the EPA, this is to combat pollution from ships and coordinate control methods.

4.4.6 Fisheries Directorate (Fiskeridirektoratet)

The Directorate of Fisheries was established in 1995 and is currently under the Ministry of Food, Agriculture and Fisheries. The prime job of the directorate is

administration and inspection in relation to the various fishing activities. Therefore most of the employees work in the local units throughout the country and at sea on board inspection vessels. As part of The Ministry of Food the chief purposes of The Directorate of Fisheries is to work for the following:

1) Fresh and good fishery products for the consumer
2) Preservation of the stocks
3) Sustainable fishing
4) A healthy and economically strong fishing trade
5) Recreational fishing for as many as possible in salt as well as in fresh water.

The general framework for Danish resource management is the Common Fisheries Policy (CFP) of the European Community. The CFP contains an agreement on the allocation of resources between member States as well as general rules on technical conservation measures, fisheries control and market arrangements. Once the TAC (total allowable catch) or quota agreement is adopted in December, the national management scheme is decided by Ministerial Order (under the Fisheries Directorate). A series of national management schemes has been put into operation in order to achieve continued fishing opportunities, whilst at the same time ensuring that Danish quotas allocated under the CFP are not exceeded. Once again the Fisheries Directorate is responsible for maintaining these schemes.

After the most recent TAC allocation, Dr Joe Borg (Member of the European Commission responsible for Fisheries and Maritime Affairs) gave a speech about the TAC and Quotas for 2005 at a press conference in Brussels. Commented that “the gradual application of measures necessary to rebuild depleted stocks without economically crippling the fleets concerned”. He continued “in the Baltic Sea, we have extended the summer ban to four-and half-months, introduced closed areas and reduced quotas and, more importantly, control measures will now cover all vessels over 8 metres”. In the North Sea, “we have introduced a small reduction in the days at sea and an incentive for member States that support a commitment to the automatic institution of administrative sanctions where the conditions of the permits are not respected and to the setting of closed areas”. The Fisheries Directorate collaborates with the DMA and Forest and Nature Agency with the establishments of ‘no go zones’.

4.4.7 National Survey and Cadastre (Kort & Matrikelstyrelsen)

National survey and cadastre (KMS) was formed in 1989 by merging three spatial data government institutes. Currently KMS is part of the Ministry of Environment. KMS is the central authority for surveying, mapping, cadastral registrations and the authorization of surveyors. The KMS tasks are based on four areas of responsibility: the reference networks, topographic maps, nautical charts and the Cadastre.

The Cadastre forms the basis for the registration of land property in Denmark. KMS is the governmental authority for cadastral registrations. Due to changes in society's needs a number of initiatives concerned with the streamlining of the whole process of formation of real property including a transformation of the five most important registers have been taken. It is seen necessary to coordinate the large investments for society in order to cut down on the present duplication of work and the overlap in registrations and to create a modern digital administration of real property.

The cadastral system in South Jutland was established on the basis of the old German registrations when South Jutland was reunited with Denmark in 1920. The regional system also differed from the system in the rest of Denmark in that the surveyors employed in the South Jutland Cadastre performed the cadastral surveying in the field as opposed to the rest of Denmark, where this is performed by licensed surveyors in private practice. In 1999 the Danish Parliament decided to partly privatize the South Jutland Cadastre so that the cadastral work in the region is carried out in a way similar to the rest of the country. The KMS decreased its activities accordingly, but one office remained to approve cadastral changes.

Due to considerations about sovereignty and safety at sea KMS has the monopoly of producing charts. Charts are made according to international agreements. By July 2000 the Danish waters had been covered by electronic charts, but they still produce charts on paper as well. During the last ten years Denmark and ten European countries have established PRIMAR (software) and STAVANGER, a regional centre in Norway for coordinated distribution of official, electronic charts.

4.4.8 Royal Danish Administration of Navigation and Hydrography (Farvandsvæsenet)

The Royal Danish Administration of Navigation and Hydrography (RDANH) was created in 1973 when four separate institutions were merged and put under the Ministry of Defence. The mission is 'to contribute to the safety of navigation at sea in Danish, Faroese and Greenland waters'. This is achieved through fives areas: sea rescue, buoys and markers, harbours pilots, bathymetric, oceanographic data.

The RDANH determines guidelines for buoyage, grants licences and issues orders regarding buoyage, handles cases concerning installations and work in Danish waters and cases concerning wrecks. In conjunction with the discharge of authority, mariners are regularly supplied with information via the publication of Notices to Mariners, coastal and local warnings, etc.

RDANH establishes, operates and maintains systems and buoyage to assist in positioning and navigation in principal waters, transit routes and to secure anchorage in accordance with the Danish legislation on safety at sea. That means establishing, operating and maintaining lights, light buoys, beacons, day markers and radio navigation systems as required.

As part of the Danish sea rescue services, the RDANH operates the Coastal Rescue Service including 21 lifeboat stations. All resources, including the boatmen with their intimate knowledge of their local environment are made available to Admiral Danish Fleet in his capacity as Maritime Rescue Coordination Centre.

The RDANH is the parent Danish authority for pilotage and operates the Pilotage Authority with exclusive rights for pilotage in Danish territorial waters. The Pilotage Authority is a self-supporting and financially independent organisation, whose rates are determined by the Minister of Defence. The pilot stations provide navigators with local knowledge and expertise for shipping transiting Danish waters or calling at Danish ports. This supports safety of navigation and contributes to protect the environment.

Conduct hydrographic surveys and provide oceanographic information RDANH is responsible for hydrographic surveys in Danish waters. RDANH undertakes collection of hydrographic and oceanographic data. Hydrographic surveys are carried out by naval personnel and ships as directed by RDANH. RDANH does not produce any charts, rather gives the data to KMS as the only government body that produces maps and charts. However RDANH response too many request from data from private and public organisation. RDANH supplies data to KMS for the publication of nautical charts.

4.5 SWOT Analysis

As a method of assessing and summarising the current marine management system, a SWOT Analysis has been conducted. The analysis has used information in this Chapter, which was primarily gathered from interviews of the different governance organizations.

4.5.1 Strengths

Collaboration – it was that there is a very open dialogue between different government bodies within Ministries as well as between Ministries. These open dialogues existing both in formal interagency links but also on informal ad-hoc bases.

Public Consultation – there is excellent public consultation with many groups. This is in relations to not only environment impact assessments (EIA) but also planning schemes. In fact some NGOs have a statuary right comment and object to spatial planning scheme.

Open Dialogues – there is open dialogue and collaboration both between Danish Ministries and Ministries from other countries. Official inter-Ministry bodies existing between Nordic countries as well as countries bordering both the North and Baltic Seas.

Expertise – with many bodies sharing the roles of the marine management, it means that each part is done very well and not neglected. There is no one large agency responsible for everything. This means experts are used when they are needed. For

example, although KMS does not have jurisdiction below the high water mark, it still produces the nautical charts, as it has the expertise for creating and production maps.

Integrated Coastal Management – There is a long history of coastal management. Initially driven by the need to protect the coastal from storm surges now covers all areas of management. This involves extensive public consultation in almost all areas of planning and development.

4.5.2 Weaknesses

Data Currency – the survey data is very old. Hydrographic data is timely and costly to acquire in the filed. Up until 1991, 'data accuracy, and completeness are poor' from surveys (KMS 2004), with only the main shipping channels been surveyed since then.

Policy – there is no one marine or oceans policy that can be looked towards for direction and strategy. This means that while sectors have polices, there is no higher policy to give direction and coordinate the overall marine environment.

Legislation – Spatial definitions in the coastal and marine environment. Grey area in the coastal zone over jurisdiction. There are still some conflicts of interest and contradictions between legislation, particularly concerning the marine area. There is no legal basis for integrating planning across the intertidal shore. Management of the offshore marine area is the responsibility of the State and is subject to sectoral legislation.

4.5.3 Opportunities

New Technologies – with wind farms emerging as viable renewable energy source and aquaculture providing to be an alternative to fishing wild stocks, it is critical to management these new industries to ensure that there benefit can be maximised.

Lead the Way – as there is minimum progress in the area of holistic marine management systems in Europe and the EU marine strategy will in the next few years be in place. There is an opportunity to become a regional leader and if so, then market and sell knowledge.

4.5.4 Threats

International Obligations – without holistic system, obligations could be neglected or not fully completed with. For example, if two departments think each other are responsible for a particularly obligation, it could be overlooked.

Conflict Interest – Currently without a holistic view of the marine environment, it is hard to identify conflicting interest. Currently competing interest could be coexisting without incident, but in the future a change of conditions might result in conflict.

Time – it seems as time goes on it would be harder to implement change. Without continual evaluation and improve of processes complacent can emerge over time.

4.6 Conclusion

Denmark's has long tradition of maritime administration, however due to this long history, the current system while functional, is sector based with minium horizontal integration. A SWOT analysis reviewed issues: Strengths (Collaboration, Public Consultation, Open dialogues, Expertise), Weakness (Data Currency, Policy, Mindsets, Legislation), Opportunities (New technologies, Lead the way, Restructuring), Threats (International obligations, Time).

5 PROBLEM STATEMENT

The intension of this Chapter is to answer the initial problem statement by supporting assumptions with evidence from Chapters 2, 3 and 4. After that a second problem statement will formulate to focus on addressing the second research aim.

5.1 Initial Problem Statement

Agenda 21 and UNCLOS are agreements that sovereign States adopt as ways they will manage and govern there countries. Both agreements give guidelines and principles for the management and development of the environment. Agenda 21 states the need for 'legal instruments' and 'information for decision-making'. UNCLOS identifies the need for individual countries to manage there marine resources with their increased territorial responsibilities under UNCLOS (PCGIAP, 2001). However, while these and other initiatives set out principles and guidelines, they do not tell countries how to accomplish them – this is left up to the individual countries. This gives evidences and supports the assumption that there is a new global agenda [Initial Problem Statement i)].

As seen in Chapter 3, countries are developing and adopting different systems tailored to their country's unique situation and context. The cases all have a similar theme of creating an integrated holistic tool of governance for the marine environment. By doing this they have been able to better fulfil there obligations of Agenda 21, UNCLOS, international agreements as well as interesting there capacity for informative decision-making. This supports the assumption that countries are altering their marine management systems to align with the new agenda [Initial Problem Statement ii)].

Finally from the SWOT analysis in Chapter 4, it is clear that while Denmark's current marine management system is sufficient, there are areas that could be improved. While there are good channels of communication, the overall regime is still sector based, lacks a single direction through policy or strategy and is not totally aligned is the new agenda [Initial Problem Statement iii)].

Now that assumptions and the initial problem statement have been supported, a second problem statement needs to be formulated to address the second research aim of the thesis, '*To identify challenges, barriers and benefits in adopting or implementing a new marine management system'*.

The areas of improvement generally focus around the need for better holistic management. Unlike countries studied, Denmark does not have a holistic management system for the marine environment and there is an absence of an overarching oceans / marine policy. Management is based on the historical evolution of industries (sectors) in the oceans. While there is some horizontal integration between sectors, it is limited to specific tasks or on an ad-hoc basis. This sectored system is task specific in the management of rights, restrictions and responsibilities in the marine environment.

'The spatial infrastructure supporting the administration will need to be coherent, appropriate and affordable. It should enable the alignment of all systems and procedures of rights, usage and management so that the spatial referencing is consistent and readily interrelated for all users. There is now a great opportunity to develop a spatial information infrastructure theme as a component of the wider marine resources infrastructure.' (Robertson, Benwell et al. 1999)

As there is minimal research in this area in Denmark, it is hard to build on existing research. Consequently, this report will conduct a generally study of influencing factors for Denmark as well as marine administration theories. This will hopefully be more beneficial than selecting a model and evaluating if it would or would not fit a Danish context.

Problem Statement: *if there is no integrated holistic marine management system in Denmark, then i) what are the factors that would affect such a system in a Danish context? and ii) what are some of the fundamental elements to such a system.*

5.2 Objectives

There are two parts to the problem statement addressing the second research aim. Firstly, factors will be examined (both external and internal) so that the context is understood, for which a new management system would have to be designed to fit. Secondly, cadastral models and frameworks will be explored at a conceptual level as one fundamental element of a spatial dimension to integrated holistic marine management.

- *Identify external influencing factors* (Chapter 6) – This will look at where Denmark is situated and identify global and regional factors. This will include binding and non-bind conventions, treaties and agreements.
- *Identify internal influencing factors* (Chapter 7) – This will look at the key conventions of UNCLOS and Agenda 21 are being implemented, the current land administration system and SDI to examine how it treated in the marine environment, profile of key sectors in the marine environment and how the coastal zone is managed.
- *Investigation of spatial dimension* (Chapter 8) – This will explore the spatial dimension as one element of a new management systems. This will focus on cadastral models that can help register marine interest and their spatial component. Not only examining cadastral models, the investigation will also explore how they might fit into a board SDI. Briefly, also policy issues will highlight the overall context of how spatial data fits into a holistic management system.

5.3 Methodology (Part Two)

Similar to Part One, the primary method of research for the second part is literature reviews.

Report Structure – Below is a diagram of the structure of the second part of the report. It can be seen that from the formulation of the new problem statement in this Chapter, three objectives will be addressed separately and in independent Chapters. After that an analysis Chapter will use the knowledge from Chapters 6, 7 and 8 to answer the problem statement in Chapter 5. Finally the last Chapter will assess the entire thesis as

a whole and conclude with recommendations and possibly the direction of future research.

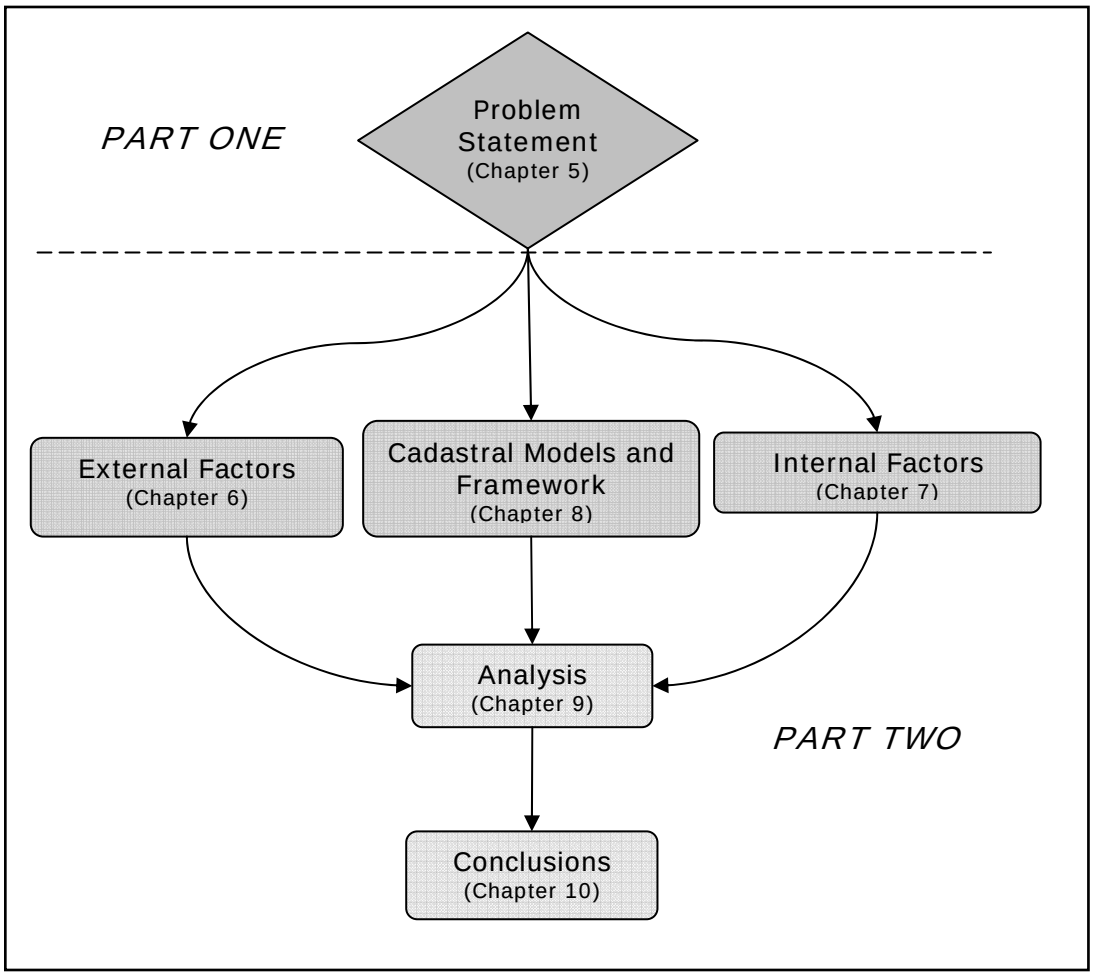


Figure 5.1 – Report Structure: Part Two

PART TWO

This part of the report will endeavour to address the second aim of the thesis, '*to identify challenges, barriers and benefits in adopting or implementing a new marine management system'*. This will be accomplished as set out in section 5.2 Methodology. Further this part includes an analysis Chapter liked to the problem statement in Chapter 5, and a final conclusion Chapter assessing the entire thesis.

This part includes:

- Identify external influencing factors (*Chapter 6*)
- Identify internal influencing factors (*Chapter 7*)
- Examine cadastral models and framework (*Chapter 8*)
- Analysis of Part Two (*Chapter 9)*
- Assessment of analysis and thesis (*Chapter 10*)

6 DENMARK'S EXTERNAL FACTORS

The intension of this Chapter is to identify key global and regional organisations, agreements and other obligations that Denmark is committed to and has duties to uphold. While not being an exhaustive list, the Chapter aims to identify the most important factors that would have to be considered when considering new ways of managing Denmark's marine environment.

6.1 Global

The Danish Ministry of Foreign Affairs (Udenrigsministeriet) describes Denmark as 'a small, active international player and a major donor'. This is very true, as a founding member of the United Nations, Denmark remains committed to 'both the letter and the spirit of the UN Charter'. Denmark donates over 4 billion Danish kroner to international organisation (Udenrigsministeriet, 2005). This aid is given to many organisations for many different purposes including security, human rights, and economic and social development as well as the environment.

As an active member of the world community, Denmark has signed many international treaties and conventions. Not only providing financial support, Denmark often sends delegates to forums as well as peacekeepers to international hot spots. The marine environment is no exception, as seen in Appendix E, Denmark has signed on to most international maritime conventions as well as UNCLOS and the Agenda 21 programme.

6.1.1 United Nations

Denmark sees the UN as the main forum for dealing with global issues and as such it is a cornerstone of the Danish foreign policy. Almost 1.5 billion of its 4 billion kroner in international aid is donated to different UN organisations. Areas of particular importance are 'common security and peacekeeping, promotion of democracy and human rights, economic and social development, and protection of the environment' (Udenrigsministeriet, 2005). This year and next, Denmark will be serving in the UN Security Council as one of the non-permanent positions, which it will hold the Presidency in May this year.

Throughout the 1990's, when the UN went through a financial crisis caused by the non-payment of dues by certain member States. Denmark and other EU countries maintain that the UN cannot be financially secure unless member States honour their obligations and pay their contributions in full, on time, and without conditions.

Under the UN, the marine environment is looked after by several organisations, UNEP, FAO, IMO and other UNCLOS organisations. Denmark is committed through the Maritime (IMO), Fisheries (FAO) and Sustainable Development (Agenda 21). UNCLOS has been discussed in Chapter 2, however it is important to note that by ratifying UNCLOS, it creates binding procedures for settlements of disputes between Denmark and other States that have ratified the Convention.

6.1.2 International Maritime Organization

The International Maritime Organisation (IMO) was created in 1948 by the United Nations. Originally called the Inter-Governmental Maritime Consultative Organization (IMCO), but this was changed in 1982 to IMO. The IMO Convention entered into force in 1958 and the new organisation met for the first time the following year.

The purposes of the IMO, as summarized by Article 1(a) of the Convention, are "to provide machinery for cooperation among Governments in the field of governmental regulation and practices relating to technical matters of all kinds affecting shipping engaged in international trade; to encourage and facilitate the general adoption of the highest practicable standards in matters concerning maritime safety, efficiency of navigation and prevention and control of marine pollution from ships".

Over the last 50 years there have been many international conventions affecting the marine environment, see Appendix F. Further more in Appendix E, it can be seen that Denmark is a strong supporter of international agreements by its willingness to ratify almost all conventions.

The Royal Danish Administration of Hydrology and Navigation along with the Danish Maritime Authority are the primary representatives for Denmark to the IMO. The Danish Environment Protect Authority is also involved and with the IMO Marine

Environment Protection Committee (MPEC). Denmark is bound by IMO regulation, which the above three organisations have the responsibility of implementing in Denmark.

6.1.3 International Hydrographic Organization

The International Hydrographic Organization (IHO) is an intergovernmental consultative and technical organization established to support the safety in navigation and the protection of the marine environment. The IHO has 72 member states as of January 2003. The aim of the Organization is to bring about:

- The coordination of the activities of national hydrographic offices.
- The greatest possible uniformity in nautical charts and documents.
- The adoption of reliable and efficient methods of carrying out and exploiting hydrographic surveys.
- The development of the sciences in the field of hydrography and the techniques employed in descriptive oceanography.

Denmark is represented at the IHO by both National Survey and Cadastral and Royal Danish Administration of Hydrology and Navigation. IHO is structured so that it has 15 Regional Hydrographic Commissions. Denmark is represented on three of the commissions: North Sea Hydrographic Commission (NSHC), Nordic Hydrographic Commission (NHC) and Baltic Sea Hydrographic Commission (BSHC).

The National Survey and Cadastre agency is part of an international cooperation for the provision of ‘consistent, timely and reliable Electronic Navigational Chart (ENC) called Primar Stavanger. The core aim is to provide the maritime community with an ENC service recognised for its quality, user-friendliness and overall contribution to marine safety and efficiency on a global level. ENC are the official digital chart data authorized by National Hydrographic Office in accordance with the IHO product specification.

6.2 European

European as continent operates in different ways, but primarily under the European Union, particular with the recent expansion. However also within Europe, there are

many subregions of which Denmark is part of the Nordic / Scandinavian region as well as belonging to the ecological regions of North Sea and Baltic Sea.

6.2.1 European Union

The EU creates an environment, through the members States, which is committed to work together for peace and prosperity is unique. Some sovereignty is delegated to EU institutions and decisions on specific matters of joint interest are made democratically. This pooling of sovereignty can be referred to as 'European integration'. This European integration is achieved through five main institutions as well as other agencies and bodies:

1. **European Parliament** (elected by the peoples of the Member States)
2. **Council of the European Union** (representing the governments of the Member States)
3. **European Commission** (driving force and executive body)
4. **Court of Justice** (ensuring compliance with the law)
5. **Court of Auditors** (controlling sound and lawful management of the EU budget)

Denmark is bound by EU legislation in the marine environment in mainly areas including the Environment, Fisheries, Energy and Transport (see Appendix G). However as is common with national legislation, this legislation is segmented to specific industries and there is minium holistic marine environment policy in the EU. From 1996 to 1999, the European Commission operated a Demonstration Programme on Integrated Coastal Zone Management (ICZM) designed around a series of 35 demonstration projects and 6 thematic studies. From the programme an 'Integrated Coastal Zone Management: A Strategy for Europe' was communicated to the European Parliament. However this is only for the Coastal Zone and not the entire marine environment.

During the Danish EU Presidency in 2002, a conference on the development of a European strategy for protection and conservation of the marine environment was held in Køge, Denmark. It highlighted that the protection and conservation of the marine environment was of 'the outmost importance' for Europe and was an issue of 'high priority' during the Danish EU Presidency. The aim of was to initiate a multi-stakeholder process, this was communicated by ways of a European Commission

publication in 2002, *Towards a strategy to protect and conserve the marine environment*, to the European Parliament. The intension was to develop a strategy in close cooperation with member States, the European Parliament, EEA, member States and candidate countries as well as NGOs.

In March this year, the European Commission started work on a Green Paper for an all embracing Maritime Policy. The European Commission decided to launch a consultation process on a future maritime policy for the Union. The Strategic Objectives of the Commission for 2005-2009 noted "the particular need for an all-embracing maritime policy aimed at developing a thriving maritime economy and the full potential of sea-based activity in an environmentally sustainable manner". A Green Paper on a future EU Maritime Policy, to be adopted by the Commission in the first half of 2006, will constitute a first step towards the establishment of an all embracing EU Maritime Policy, in line with the Commission's strategic objectives.

6.2.2 European Maritime Safety Agency

The European Maritime Safety Agency (EMSA), created in the aftermath of the Erika disaster, contributes to the enhancement of the overall maritime safety system in the European Community. Its goals are to reduce the risk of maritime accidents, marine pollution from ships and the loss of human lives at sea.

EMSA provide technical and scientific advice to the European Commission in the field of maritime safety and prevention of pollution by ships. This advice goes towards updating and developing new legislation and ensures its implementation and enforcement is effectiveness. EMSA officials closely cooperate with member States maritime services. It responds to specific requests by member States in relation to the practical implementation of EU legislation. EMSA facilitates cooperation between the member States and encourages best practices in the European community.

EMSA contributes to the process of evaluating the effectiveness of EU legislation by providing the European Commission and the member States with 'objective, reliable and comparable information' on maritime safety and on ship pollution. To ensure effective implementation of the large amount of maritime legislation, there is an

active ongoing dialogue and cooperation between 27 European States and the European Commission.

6.2.3 EuroGeographics

EuroGeographics is an intergovernmental organization representing the National Mapping and Cadastral Agencies (NMCAs) of Europe working for the development of the European Geographic Information Infrastructure. EuroGeographics was formed by a merger of CERCO (Comité Européen des Responsables de la Cartographie Officielle) and MEGRIN (Multi-purpose European Ground Related Information Network) in 2000. KMS is Denmark's representative organisation on EuroGeographics.

The organisation has 40 countries members including non-EU countries in eastern Europe as well as Russia and Turkey. The vision of EuroGeographics is to achieve interoperability of European mapping and other Geographic information data. The objective is realised by the below objectives:

- to continue as the official and united voice of Europe's NMCAs
- to promote the NMCAs national and pan-European products and services and their leadership in building the European Spatial Data Infrastructure (ESDI)
- to promote EuroGeographics as Europe's leading forum for the exchange of ideas
- to promote collaboration and sharing of best practise between our members
- to help the EuroGeographics with its programmes and directives

6.2.4 INSPIRE

The European Commission adopted a proposal for an INSPIRE (Infrastructure for Spatial Information in Europe) directive in 2004. Yet the full adoption of the directive is not expected until 2006, with pilot projects and investigations being carried out in the meantime. Historically, INSPIRE was actually created in 2001 by the Environment Directorate General of the European Commission. The initiative was to create a common spatial infrastructure for the environmental sector. However with its full adoption, the aim was to make certain spatial data interoperable on a local, national and European level and across sectors. It is critical that infrastructure is connected with contingency planning in case of emergencies (eg flooding, acute

pollution or terrorism) and the daily administration (eg registering and monitoring) as well as planning on a locally, nationally and European level. In order to achieve this and combine data across borders, INSPIRE sees it is necessary to establish a common European spatial information infrastructure. The directive involves a gradual development of such a harmonized infrastructure in the EU countries.

The Ministry of the Environment strongly supports the intentions behind the INSPIRE initiative. Working groups have been established at local, county and national level. KMS chairs the working groups as well as being the Danish representative at an international level. So far most of the efforts have gone into standardisation on the national, which will in turn correspond and link to the European efforts.

6.3 Nordic Region

With the region of Europe, the Nordic region has many agreements and programs to work together towards common goals. There is a Nordic Council which cooperation is to achieve more together than the individual countries are capable of on their own – “Nordic synergy". There are also many other intergovernmental bodies like Council of the Baltic Sea States (CBSS) and the Committee of North Sea Senior Officials (CONSSO). Denmark, Finland, The Faroe Islands, Iceland, Norway and Sweden have concluded a formal agreement on the Nordic Cooperation within mapping, geodata and cadastral data (KMS, 2005). Below are some of the key agreements and organisation that Denmark is a partied to.

6.3.1 Wadden Sea Declaration

While the Wadden Sea Declaration was signed in 1982 by The Netherlands, Germany and Denmark, the collaboration started in 1978 with a trilateral government conference. As such it is one of the oldest international environment protection agreements. At the time scientists stated that the ecosystem of the Wadden Sea cannot be divided according to national borders, as ecological it is one system. In the 1982 declaration, the countries declared their intention to coordinate their activities and measures for the protection of the Wadden Sea. Since then conferences have been held every 3 – 4 years, with trilateral working groups meeting several times per year in between conferences. The working group is composed of civil servants of the responsible ministries and other relevant ministries as well as regional authorities.

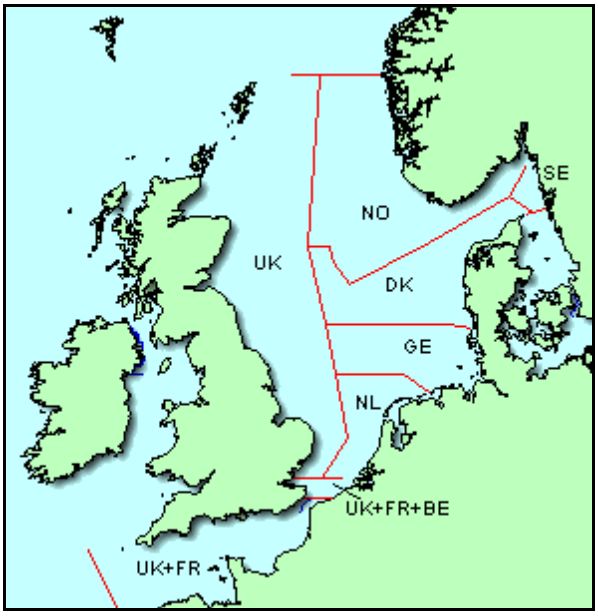
The tasks of the Common Wadden Sea Secretariat are to support, initiate, facilitate and coordinate the activities of the collaboration. This includes areas such as the Trilateral Wadden Sea Plan, EIA, monitoring and assessments, management and publications. In 2002 major parts of the Wadden Sea was designated as a Particularly Sensitive Sea Area (PSSA) in accordance with the MARPOL Convention.

6.3.2 Bonn Agreement

The first Bonn Agreement was signed in 1969 following some major oil spills. The Agreement was developed to encourage the North Sea states to coordinate effects and basic capacity for combating oil pollution. The current Bonn Agreement (1983) is a commitment by North Sea coastal states together with the European Union to i) offer mutual assistance and cooperation in combating pollution, and ii) execute surveillance as an aid to detecting and combating pollution and to prevent violations of anti-pollution regulations.

In recent years the emphasis has been on the coordination of surveillance activities, including the opportunities offered by satellite surveillance. The results of aerial surveillance are assessed and published. The North Sea is divided into different zones where the responsibility for the surveillance and assessment of incidents is assigned to different Bonn Agreement members. Interestingly the surveillance zones do not align with national borders.

The Danish Ministry of Defence is the contingency organisation for combating pollution of the sea caused by oil and other harmful substances is the. Regarding illegal discharges into the sea from ships, Defence Command Denmark is the enforcement organisation. The enforcement jurisdiction for violations of this Act are the Danish territorial waters and the EEZ and beyond this area where it is consistent with international law like UNCLOS. The Act is based on MARPOL Convention and incorporates the regulations concerning discharges into the sea. The EPA is the organisation that administration of legislation concerning environmental protection and environmental regulation of offshore activities.



(Bonn 1999)

Figure 6.1 – Bonn Agreement Surveillance Zones

6.3.3 INTERREG III B (North Sea and Baltic Sea)

INTERREG III B is a European Community initiative that creates programmes to address trans-European cooperation and will encourage harmonious and balanced development of the European territory. Strand B of the INTERREG III initiative supports transnationals cooperation projects. It is sponsored by the European Regional Development Fund (ERDF), as part of the Structural Funds, and co-financed by national project partners. Currently there is an Interreg IIIB programme for both the North Sea and the Baltic Sea.

The INTERREG III B North Sea Programme supports projects focusing on transnationals cooperation in spatial development in the seven countries of the North Sea Region. In a complex world of European funding, the programme offers pragmatic advice to help all applicants through this process.

The Baltic Sea Region INTERREG III B program aims to address spatial development approaches and actions for specific territories and sectors, promotion of territorial structures and transnationals and bilateral institution and capacity building in the Baltic Sea Region. Due to EU enlargement, Estonia, Latvia, Lithuania & Poland are four new members States which are now eligible for full participation in programme.

6.3.4 OSPAR

Oslo and Paris Conventions (OSPAR) is protecting the entire North-East Atlantic region including the North Sea and Kattegat, against all forms of pollution. The convention has been signed by all EU member States, as well as Iceland, Norway and Switzerland. OSPAR sets out regulatory agreements for the prevention of pollution in the maritime area of the North East Atlantic. It aims to prevent and eliminate pollution from any sources including land-based sources, offshore oil and gas installations and from the dumping of wastes at sea.

OSPAR develops and implements strategies for the prevention of pollution in the North East Atlantic, taking into account both scientific and technical considerations as well as environmental management policies. Scientific and technical advice is drawn from established research programmes in the member countries as well as from the International Council for the Exploration of the Sea (ICES) which provides formal advice as well as data handling services for the Commissions. Over the years, the OSPAR Commission has adopted numerous binding measures.

6.3.5 HELCOM

For the first time ever, all the sources of pollution around an entire sea were made subject to a single convention, signed in 1974 by the then seven Baltic coastal states.
The Helsinki Convention entered into force in 1980, however a second updated new convention was signed in 1992. The Convention covers the whole of the Baltic Sea area including the seabed, Kattegat and inland waters. Measures are also taken in the whole catchment area of the Baltic Sea to reduce land-based pollution.

The governing body of the Convention is the Helsinki Commission, Baltic Marine Environment Protection Commission, also known as HELCOM. HELCOM information and communication strategy has been partially funded by the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety of Germany and by the Danish Environment Protection Agency.

Since its formation, HELCOM has been working to improve the Baltic marine environment, largely through some 200 HELCOM Recommendations. Successes over the years include:

- Lower discharges of organic pollutants and nutrients from point-sources
- 20-25% overall reduction in the emissions of oxygen-consuming substances
- Fewer beaches closed for bathing
- Stricter controls on industry
- Improved joint monitoring of the state of the marine environment.
- Recovery of seal and white-tailed eagle populations.

6.4 Other organizations

Above are some of the major conventions, organisation and initiatives that Denmark is currently a partied to. This list is by no means exhaustive, but it hopefully highlights the extent and degree of external factors that play a role in the Danish marine environment. Below are some more.

Baltic 21 – this is a intergovernmental initiative by Prime Ministers of the Baltic Sea Region to develop a regional Agenda 21 plan. It aims for sustainable development encompassing economic, social and environmental aspects. The Agenda 21 for the Baltic Sea Region was adopted in 1998 by the 11 countries. The Baltic Sea Region is the first region in the world to adopt common regional goals for sustainable development.

Conet CZA 21 – Coastal Network Coastal Zone Agenda 21 (Conet CZA 21) is an NGO to promote a sustainable coastal zone development in the Baltic Sea Region. CoNet CZA 21 aims to development and test of new strategies for an environmental relief of the Baltic Sea, comprehensive (holistic) treatment and consideration of the coastal zone / integration of land and sea and comprehensive and active participation of the public. It sets out several procedures to achieve these aims most of them including utilisation and networking of existing local and regional public groups.

EUCC – is an association with members and member organisations in 40 countries. It was founded with the aim of promoting coastal conservation by bridging the gap between scientists, environmentalists, site managers, planners and policy makers. The mission is ‘promote coastal management that integrates biodiversity conservation with those forms of development that sustain the integrity of landscapes, the cultural heritage and the social fabric of our coasts taking into account the effects of climate

change'. It is the largest network of coastal practitioners and experts in Europe, with 14 National Branches and offices in seven countries. Its work covers European seas but also neighbouring regions including the Black Sea and the Caspian.

KIMO – Kommunenes Internasjonale Miljorganisasjon Organisation (KIMO) is an international association of Local Authorities, comprising over 128 members in 10 countries. It works towards cleaning up pollution in the North Sea. It holds NGO status at CONSSO conferences, OSPAR and as part of the WWF delegation to IMO. It has links with the European Parliament and Commission and sends representatives to various stakeholder dialogue processes in various countries.

ICES – International Council for the Exploration of the Sea (ICES) is the organisation that coordinates and promotes marine research in the North Atlantic. Article 2 of its convention states that it is concerned with Atlantic Ocean but this includes adjacent seas such as the Baltic Sea and North Sea. ICES act as a meeting point for scientists from the 19 member countries around the North Atlantic as well as other affiliates countries around the world (Australia, Chile, Greece, New Zealand, Peru and South Africa). It scientific knowledge is distributed in many ways including the ICES Journal of Marine Science.

VASAB – Vision and Strategies around the Baltic Sea (VASAB) is an intergovernmental (10 countries) programme on multilateral cooperation in spatial planning and development. The scope and directions of VASAB work is determined by participating countries. VASAB contribute to the cooperation framework for defining the main spatial development needs for integration of the Baltic Sea Region territory and to initiate necessary actions.

6.5 Conclusion

It can be seen that there are a multitude of organisations and conventions which cover the Danish marine territory. At the global level there are several key conventions already mentioned (UNCLOS and Agenda 21) but also international organisations that have responsibilities over particular sectors. Regionally, they all work at different level and even subregions, most have primarily concerned with the protection and conservation of the marine environment. The approaches vary, but generally there is a

main focus on shipping, pollution or sustainable development within the environment. Many overlap in areas like OSPAR and HELCOM both including the Kattegat. The questions has to be asked, *are there redundant efforts being made?*

Integration of all activities and stakeholders is a key. This integration approach is also held by from the European Fisheries and Maritime Commissioner, speaking about the new EU Marine Strategy. *"An integrated approach would help avoid conflicts and optimise synergies between the various sea-based activities so as to boost their economic potential and safeguard the environment"*

(Released on 02.03.2005)

7 DENMARK'S INTERNAL FACTORS

The intension of this Chapter is to identify factors within Denmark that influence the management of its marine environment. It will explore how UNCLOS and Agenda 21 are being implemented, profile key sectors in the marine environment as well as look at existing infrastructure and administration. The Cadastre system will be profiled, so that in Chapter 9 comparisons can be made with marine cadastre models. This Chapter will not be looking at institutional issues, as they have already been discussed in Chapter 4.

7.1 Agenda 21

Denmark is applying Agenda 21 at regional, national and local level. This section will focus on both national and local action plans and their results, as regional initiatives have been explored in Chapter 6.

At a national level, the Ministry for Environment is the key coordination mechanism for sustainable development in Denmark. This is also an inter-ministerial Committee, called the UNGASS Committee. The Ministry of Foreign Affairs chairs the committee and it includes the Prime Minister's Office, the Ministry of Energy and Environment, the Ministry of Business and Industry, the Danish Ministry of Housing and Building, the Ministry of Food, Agriculture and Fisheries, the Greenland Home Rule, the Faroese Government Office, and representatives of the Danish NGO Community and the private sector also participate (CSD 1997).

In the 1997, Danish Country Profile by Commission on Sustainable Development (CSD) ranked the status of availability of information to each Chapter of Agenda 21. Denmark faired well with no Chapters categorised as Poor, 6 as some gaps, 27 as good and 5 as very good. While Chapter 17 (Oceans and seas) was classified as Very Good, Integrating E & D in decision-making, Education, public awareness and training, and International cooperation for capacity-building came under the category of having some gaps.

Five years later in the 2002 Country Profile, it talks about the development and use of indicators for measuring sustainable development progress. It points out the Indicators for Denmark's National Strategy for Sustainable Development, *"A shared*

future - balanced development", established in August 2002. It further points out the area of 'Basic data and/or statistics – quality and quantity' is the most problematic. Arguably, the most affective Agenda 21 plans are the local ones – 'Think Global, Act Local'. Denmark has a long tradition of advanced work on environment and development, and Denmark has achieved much in carrying out Agenda 21 plans. The Spatial Planning Department (a division of Danish Forest and Nature Agency) cooperates with the National Association of Local Authorities and the Association of County Councils in Denmark in encouraging each of Denmark's counties and municipalities to prepare a local Agenda 21.

All Denmark's counties (14) and 70% of the municipalities (275) are working on various projects towards the goals of Agenda 21. The municipality or county often functions as adviser and coordinator for the citizens, organizations and companies that initiate local Agenda 21 activities.

The Municipality of Albertslund was one of the first in Denmark that opened an Agenda 21 centre, and the Municipality has made substantial progress in reducing resource consumption and negative environmental effects. The Municipalities of Vejle, Kolding, Horsens, Fredericia and Middelfart, Vejle County and 200 businesses cooperate in the Green Network on improving the environmental performance of businesses. Work is focused on each individual business and on creating networks related to the environment. The Green Network has helped to initiate the Environmental Forum Denmark, a nationwide network of 50 local environmental networks.

Storstrøm County and agricultural organizations cooperate in reducing the leaching of nutrients and pesticides, tending natural areas and protecting the wetlands around the Tubæk River. All 150 farmers in the area are being offered consultation and instruction in environmental and resource management (LPA 2005).

7.1.1 Chapter 17

The UN Commission on Sustainable Development (CSD), created by UNCED in 1992, has annually prepared Country Profile reports. According to CSD the reports serve three purposes i) help countries monitor their own progress, ii) share experiences and

information with others, and iii) serve as institutional memory to track and record national actions undertaken to implement Agenda 21. For the WSSD in 2002, the Commission comprehensive reports to mark ten years since UNCED.

The 2002 Danish Country Profile report on Chapter 17, gives a positive review of Danish activities in the coastal and marine environment. The report highlights the Coastal Planning Act (1994), designed to ensure proper development of the coastal and preserve the coast as an important landscape resource. Further highlighting national and regional programme to achieved Denmark's goal of completing a clean-sea programme by no later than 2020 in collaboration with North Sea countries. Clean-sea programme, amongst other things focusing on heavy metals and nutrient levels. 94 percent of sewage discharges are subject to secondary treatment and 67 percent to tertiary treatment (CSD 2002).

While the report was generally very positive, pointing out a database (PLAN-GIS DENMARK) for integrated coastal management including information on protected areas, habitats and uses of coastal zones. This database is only for the coastal zone, not extending out beyond the territorial sea to the EEZ boundary. Also the report did not have any information under the Capacity-Building, Education, Training and Awareness-Raising heading.

7.2 The Cadastre

The Cadastre forms the basis for the registration of land property in Denmark. Kort & Matrikelstyrelsen (KMS) is responsible for maintaining and updating the cadastre. In Denmark the Cadastre is comprised of two components: a Cadastral Register and a Cadastral Map.

The Cadastral Register (2.5 million parcel) was computerized in 1986. Due to changes in needs, a number of initiatives concerned with the streamlining of the whole process of formation of real property including a transformation of the five most important registers. The registers are the Building and Dwelling Register, The Land Register, the Cadastral Register, the Plan Register and the Real Property Taxation Register. This was done as it was seen necessary cut down on the present duplication of work

and the overlap in registrations and to create a modern digital administration of real property.

The Cadastral Map showing each land parcel and supported by measurements sheets from the cadastral archives. The Cadastral Map was digitized in 1997. The cadastral archive contains the original paper Cadastral Maps, files and the measurement sheets from the registration of the boundaries. The Cadastral Map is a legal overview map which shows the registered boundaries of land parcels and roads. All land parcels and roads in the Cadastral Map have got a parcel number.

While The Cadastre stops at the High Water Mark (HWM), interestingly there are anomalies in it. As mentioned previously, due to historical factors the Cadastre in South Jutland was developed separately. Consequently this system included some bays and other areas, which are in fact below the HWM. These are primarily for conservation and environmental purposes and are registered to government bodies and not private ownership. Also all wind turbines and some other installations below the HWM are, while not on the Cadastral Map, they are registered in the Register.

7.3 Spatial Data Infrastructure

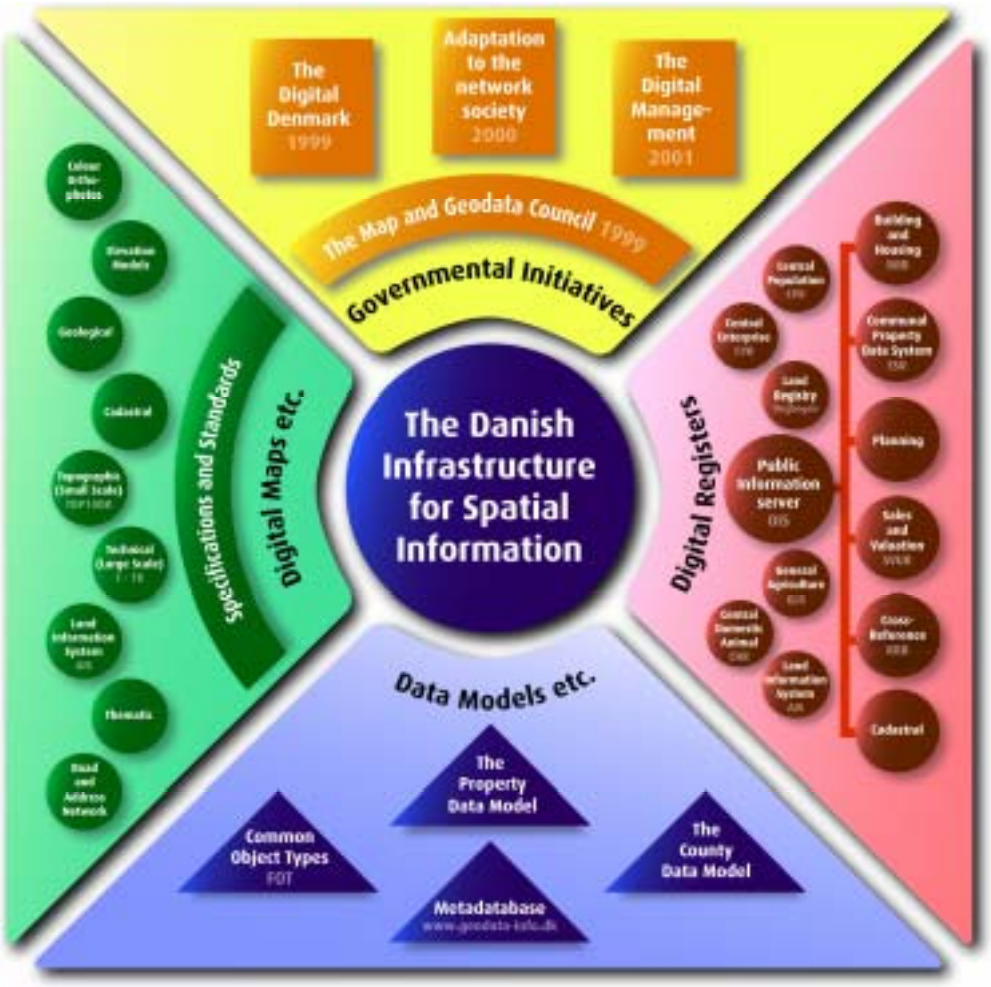
There is no official policy on Spatial Data Infrastructure (NSDI) in Denmark (Ryttersgaard 2000). However there are a number of initiatives, creating an initial framework and core datasets, with a 'de facto' approach. Key SDI players in Denmark include state (headed by KMS), county, and municipality. Private sector involvement is being lead by mapping and surveying companies. GEO-FORUM is a NGO established by an amalgamation of The Danish Society of Photogrammetry, Surveying and Remote Sensing, The Danish Cartographic Society and Danish Academy for Spatial Information.

KMS as the highest custodian authority of spatial data, it has created an initiative called Vision 2009. Two parts of this vision are Geographical Information Infrastructure and Nation-wide Collections of Data. Firstly, it sees the need for consistency in data across boundaries, both the geographical and the institutional. Secondly, to ensure maximum benefits from dataset, KMS will coordinate and develop, update and supply nation-wide datasets.

In some countries develop a national spatial data infrastructure (NSDI) with a top-down approach, in others is an out growth from established mechanisms (bottom up approach). Denmark belongs to the latter group (Enemark, Schøler et al. 2002). Regional level, counties decided to base their administration and registrations on products from the KMS. The Municipalities have had their own large scale digital maps. Over the last ten years the municipalities have established a number of regional "map-groups". These groups negotiate with mapping companies, possible users, KMS etc.

The Danish NSDI activities are mainly based on cooperation, partnership, voluntarily involvement and development of nationwide spatial products. In future years, there are plans to continue to develop the private sector and establish partnerships on common services and products. It is predicted that there will be a growth in standardisation activities, development of metadata services, and an increased request for nationwide updated datasets (Ryttersgaard 2000).

In the report "The Digital Denmark – adaptation to the network society" published in November 1999 the Ministry of Research, a new IT strategy of the government was first formulated. The strategy includes the objective, that citizens and enterprises shall be able to use and profit from society's investments in public information resources in new ways. One of the sub goals in "Goal 3" is to direct the efforts towards a better and cheaper service in the public administration. This service is to be obtained through "an effective digital administration based on electronically stored data". Some of the advantages mentioned are partly the possibility of unlimited reuse of electronically stored data, and partly the possibility of quick and cheap access and distribution of data by electronic means, for example via the Internet (Daugbjerg, Simonsen et al. 2001). The situation has improved considerably in the last few years, thanks to new governmental initiatives, but also to better use of current and reliable spatial information at all levels. The initiatives and how they are related to Registers, Maps and Models, can be see to for part of the Danish Infrastructure for Spatial Information (DAISI), see Figure 7.1.



(Enemark, Schøler et al. 2002)

Figure 7.1 – Danish Infrastructure for Spatial Information (DAISI)

7.4 Sector Profiles

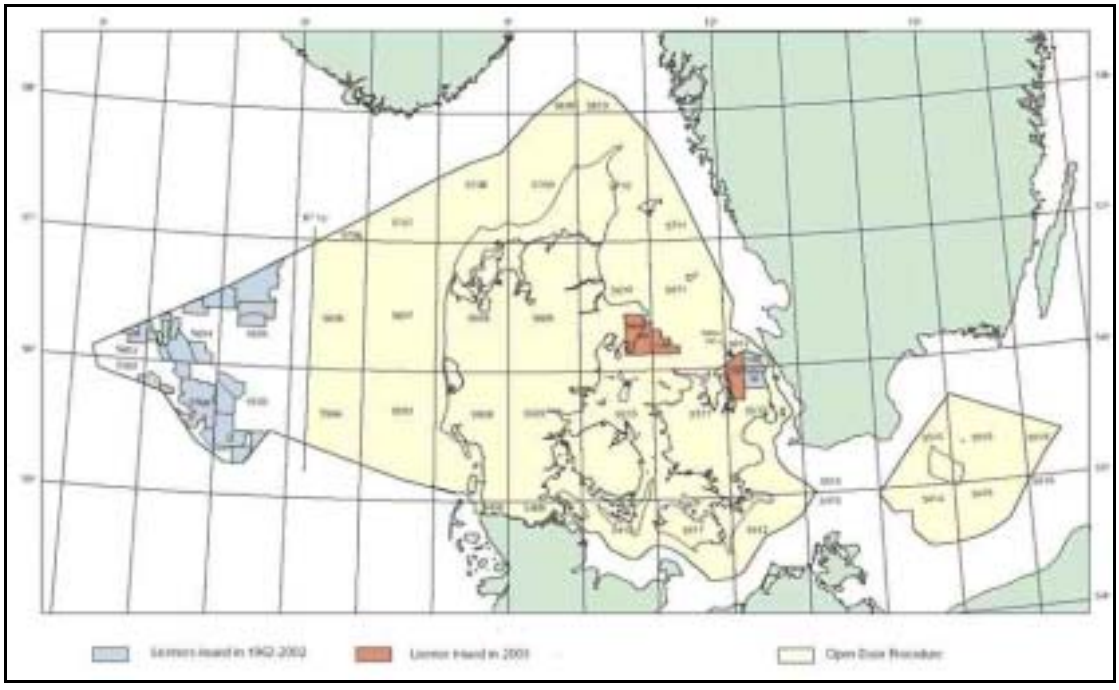
This section analyses major sectors in the marine environment that have both an economic and social impact. The major sectors are Oil and Gas, Wind Turbines, Fishing, Shipping and Transport, Tourism and Recreation.

7.4.1 Oil and Gas

The first exploration license was granted in 1935, since then there has been oil and gas exploration in Denmark. In 1966 the first well in the Danish part of the North Sea for the first time discovered hydrocarbons in Denmark. The discovery was also the first find in the North Sea. The exploration continued and a series of oil and gas fields were found. In 1972 the first oil was produced from the Dan field. Since 1983 areas in the North Sea have been offered to interested oil companies in a system of rounds. Five licensing rounds have been held and a sixth round is under preparation. All

rounds have been for areas west of the 6 15' longitude. Furthermore in 1996 an Open Door procedure for areas east of 6 15' longitude was introduced.

Since 1997, Denmark has been more than self-sufficient in energy by virtue of the production of oil and gas in the North Sea. The oil and gas activities have a favourable impact on the Danish economy. Offshore oil and gas development is expected to increase in coming years, and new pipeline links to the North Sea are anticipated. While the extraction of oil is likely to decline over the next ten years, natural gas will play an expanded role. It is the responsibility of the Danish Energy Authority to follow and evaluate the Danish and international progress in the fields of energy production, supply and research.



(DEA 2003)

Figure 7.2 – Oil and Gas area in Denmark

7.4.2 Wind Power

At this moment, four large windmill parks at sea are being planned in Denmark, three of which are in the Baltic marine area. Nordic countries are the leaders in the use of renewable energy sources, with Denmark the largest exporter of wind turbines in the world. The Danish wind turbine sector creates 20,000 jobs and exports 90% of the production abroad. The wind turbines field has developed fast since the beginning of the 1980s and, in particular, in the last ten to fifthteen years.

Today wind turbines account for a considerable proportion of electricity supplies in Denmark. As of 1 January 2005, Denmark had a wind capacity of 3118 MW, 424 MW at offshore wind-turbines. In 2003, wind power amounted to 18% of the renewable energy produced. Denmark's wind turbines reduce CO2 emissions. Other positives from and wind power covers almost 20% of the Danish power consumption and will cover 25% in 2008. In 2004, wind-power production accounted for 18.5% of domestic electricity supply electricity, which amounts to 2.9% of gross energy-consumption (DEA, 2005).

7.4.3 Fisheries and Aquaculture

Denmark has had an important industrial fishery since the beginning of the 1950's. It was originally based on herring. Today the industrial fishery is targeting sand eel, sprat, Norway pout, blue whiting and horse mackerel. The fleet involved fully or partly in industrial fishery comprises more than 300 vessels and involves around 1,000 persons on board the boats. The fishery regulations have been made very rigorous over the years, now under the EU Common Fishing Policy (CFP). The industrial fisheries sector contributes positively to the Danish balance of trade. In 1999 exports of fishmeal, fish oil and non-processed industrial fish came to approx. 1.6 billion DKK and imports were approx. 700 million DKK.

Though the overall contribution of the fisheries sector to the Danish economy is relatively minor, however fisheries constitute a very important economic activity in specific regions of Western and Northern Jutland and the island of Bornholm in the Baltic Sea (Greenpeace 1997). It is estimated that for every job at sea, there are four or five on shore in fishing-related industries (EU 1994).

Control of fisheries is dependent on the type of fish, but generally related to allocated quotas, this is done to sustain fish stocks. Each EU country is allocated fishing quotas, then each country can divide there quotas as they see fit. Interestingly the areas for allocation are not divided into national boundaries but rather using the concept of EU waters and ICES fishing areas (see Appendix D). Quotas are allocated for year. A fixed proportion of the total allowable catch (TAC) allocated to each fishing nation. These TACs are then reallocation in to further for specific areas, seasons, fisheries or

organisations. ICES assesses the stock situation for the most important industrial species each year. Interestingly while ICES makes its recommendation, the final decision is a political one made at the DG Fish.

A basic license is required to take part in all industrial fisheries. Special licenses are also needed to take part in the industrial fisheries outside the North Sea, Skagerrak and Kattegat, and for the sprat fisheries in Skagerrak, Kattegat and the Baltic Sea. The industrial fishing vessels have to keep a log-book in the same way as all other fishing vessels. Random samples are taken from the landings to check that rules on target species and by-catches are observed and to estimate the species distribution of the industrial catches The Danish Directorate for Fisheries targets its control efforts towards those fisheries that are considered important to monitor at a given time.

7.4.4 Shipping and Transport

The whole world is aware of Denmark's long and proud history as a seafaring nation. From Vikings of the Middle Ages to the fleet of modern container vessels under Danish ownership today. If both home-flag and foreign-flag tonnage are taken into account, Danish ship-owners, together with their overseas affiliates, operate some 50 million deadweight tonnes. The average age of the Danish fleet today is just seven years, compared to a worldwide average of thirteen. Danish operators are among the world's leaders in sectors as diverse as full door-to-door container services, passenger operations, specialised product carrier services.

Maritime transport is considered to be one of the most environmentally friendly modes of transport, but with an increased emphasis on high-speed travel, fuel consumption is likely to increase dramatically per kilometre travelled (Rosemarin 1996). Shipping in the Baltic Sea is intense, with around 2,000 ships at sea at any given time. Passenger ferries carry 70 million passengers a year, and oil tankers carry more than 100 million tonnes of oil and oil products annually. All of these have to go through Danish waters to get to the open seas.

7.4.5 Tourism and recreation

The main environmental problems connected with tourism in Denmark are quite small, although problems do exist, namely the large areas are taken for construction

and used very extensively but nevertheless demands infrastructure, roads, sewers, power and water supply etc, with a low utilization.

Many of the tourist accommodation and attractions are situated so that they can almost only be reached by car. This means that tourism contributes more than the average to the general problems caused by private transportation. The Danish nature and especially the beaches are generally speaking robust and able to absorb the numerous visitors. In some tourist areas however, especially on the North Sea coast, the pressure is so strong that the limit has already been reached (Barneveld, Sprink et al. 2004). In some of these areas, further development of tourism will cause damage to the environment. Trends indicate that tourists are becoming increasingly interested in higher quality tourism experiences with particular interest in cultural, historic, and natural sites (Roos and Kromp 1994). The impacts of tourism in coastal areas arise from the construction of infrastructure (e.g. hotels, marinas, transport, waste treatment facilities, groynes) and from recreation (water sports, thematic parks, beach access and parking, etc.).

The impact of recreational activities may be associated with intensive tourist development or non-tourist recreational pressures in urban and/or rural areas. Noise from motor boats and jet skis, cars and buses, nightlife and other activities is one of the more significant problems arising from recreation.

7.5 Coastal Management

Denmark has not adopted a formal definition of the coastal zone. In summer cottage areas, the protection zone is set at 100 metres but may be reduced and is increased to 300 metres in rural areas as defined by the Nature Protection Act (1992). There is a coastal planning zone extending 3 km inland from the low water line and defined in The Planning Act. A commission was set up in 1994 to establish a permanent borderline along all coasts for this strictly nature protected coastal zone and for the coastal dunes. Denmark has not formally adopted a clearly defined and coherent Integrated Coastal Zone Management (ICZM) system but ICZM principles have been brought into practice through the system of laws and regulations, inter-sectoral

coordination and planning and the high degree of public participation which has been developed over several years.

Coastal zone management in Denmark is mostly being established through gradual harmonisation and cooperation of the administrative and legislative framework, through the physical planning system and through environmental legislation. Coastal zone management objectives are incorporated into the planning system, and regional plans can provide guidelines for the rational use of coastal areas of a region, including planning of recreational activities and facilities. Involving the general public and a variety of NGOs and other organisations in the planning process underlines the integrated approach. The EPA has defined a coastal zone including bays and fjords and other marine waters extending to a depth of 6 m or at least to 1 nm from the shore-line. With respect to marine fisheries, a coastal zone extending 3 nm from the low-water line. Counties and municipalities use these definitions for there spatial planning. Seawards, restrictions have also been put on dredging and dumping activities within this defined coastal zone. Also restrictions have also been put on fishing with trawls and seines inside the 3 nm coastal zone and the use of gill nets is prohibited within 100 m from shore.

According to PROCOAST 2000 (an EU commission initiative INTERREG II C BSR) the overall state of the environment of the coast is "good". It highlights as reasons for this as many beaches are not in use or only lightly used. However it points to negative of the old coastal defence legislation hampers new initiatives for further integration of ICZM, problems with pollution are reported near harbours and larger cities, and eutrophication problems in the inner seas due especially to intensive agriculture (Barneveld, Sprink et al. 2004).

7.6 UNCLOS and Boundary Delimitation

To comply with UNCLOS, Denmark has adopted two new pieces of legislation (Act No. 411 and Act No. 200). Act No. 411 establishes the median line as the line of delimitation with States with opposite coasts, in the absence of an agreement to the contrary. The rights of Denmark in the exclusive economic zone are defined in accordance with the Convention.

Executive Order No. 584, concerning Denmark's exclusive economic zone, provides points of coordinates for drawing the delimitation line of the exclusive economic zone with opposite or adjacent States in the North Sea, the Skagerrak, the Kattegat, the Sound, the Great Belt and the Baltic Sea.

Act No. 200, Executive Order No. 242 and Royal Ordinance No. 224 on the Delimitation of the Territorial Sea, concerning the Delimitation of Denmark's Territorial Sea, governing the admission of foreign warships and military aircraft to Danish territory in time of peace.

7.6.1 Disputes

Currently Denmark still has three disputed marine boundaries.

1) Southern border between Denmark and Poland in the Baltic
2) Border in the North Sea between Denmark and Germany (Lister Dyb)
3) Border in the Sound (Øresund) between Denmark and Sweden

As these disputes are with other countries they are handled by the Ministry of Foreign Affairs. Confirmation was received from the Ministry that all three boundaries are still disputed as of 2nd May this year. Further it was confirmed that the issues would be resolved during bilateral negotiations with the relevant countries. However negotiations are not currently being undertaken or planned. The legal framework for such negotiations would be the principles codified in UNCLOS.

There are also further disputes between with Canada and Greenland (Hans Island in the Kennedy Channel between Ellesmere Island, seawards extent beyond 200 nautical miles north and Labrador Sea), Iceland and Faroe Islands (fisheries median line), and Faroe Islands' continental shelf extends beyond 200 nm with Iceland, the UK and Ireland. However all these are outside the scope of this report.

7.7 Conclusion

Addressing the first objective to answer the problem statement. It is seen that Agenda 21 has been adopted at all levels within Denmark, particularly acknowledging the high percentage at the local level. At a national level, WSSD review of Agenda 21 is generally positive including Chapter 17, however integrating decision-making, public awareness and capacity-building are identified as areas for improvement. There are

many key sectors in the marine that have economic and social significances. While these sectors generally do not compete for the same resources, their spatial area of need may, this potentially has consequences. It is seen that the Danish NSDI concept is not fully developed or mature. Consequently there are many initiatives designed to create its NSDI.

8 CADASTRAL MODELS AND FRAMEWORK

The intension of this Chapter is to explore concepts and ideas of how the need for better integrated holistic management can be realised. Initially it will identify the cadastral concept of managing interest and then how a marine cadastre might fit into a broader spatial management system. The Chapter will then explore how these concepts may be adapted or applied to the marine environment.

8.1 Marine Cadastre

United States Department of the Interior Minerals Management Service released a report entitled, 'Implementation Plan for a Multipurpose Marine Cadastre'. It summaries well, three of the key elements and needs of a multipurpose marine cadastre.

1) The Cadastre must be dynamic, that is, it must expand, evolve, and adapt to an ever changing world in order to maintain the types of detailed information necessary to provide for good ocean governance.
2) The Cadastre must be multi-dimensional and address rights, interests, and restrictions in the air column, the water surface, the water column, the seabed, as well as the subsurface.
3) The Cadastre must be balanced in its view of the marine environment. It must provide for the increasing need to develop offshore resources while simultaneously protecting sensitive and critical areas.

'The need for better spatial identification of marine interests, restrictions and responsibilities is accepted world wide' (Wallace and Williamson 2004). All registration systems relating to land are different. They reflect their country's history, needs, literacy and professional skill levels, administrative arrangements, governance and development of markets (Wallace 2004). For similar reason, such systems in the marine environment will vary between countries. However when designing a unique solution, it would be foolish to not examine current marine cadastre initiatives throughout the world, takes advantage of current international research as a guide to current problems and issues relating to the design and implementation of a marine cadastre (Binns 2004).

8.1.1 Background

The concept of a land cadastre has existed for many years. The Danish cadastre was created in 1844 when the Danish society changed from feudal based to one incorporating private ownership of land (Enemark, Schøler et al. 2002). There is no one precise definition of a cadastre as no cadastre is the same for any two countries. However, a general concept of a cadastre can be defined and does have some core common elements. This includes a geometric description of land parcels linked to other records describing the nature of the interest, and ownership or control of those interests, and often the value of the parcel and its improvements (FIG, 1995). More recently, work in the area of designing and developing a Spatial Data Infrastructure (SDI) has gained considerable momentum in government, industry and academia (Collier, Leahy et al. 2001). SDI will be discussed in a later section of this Chapter.

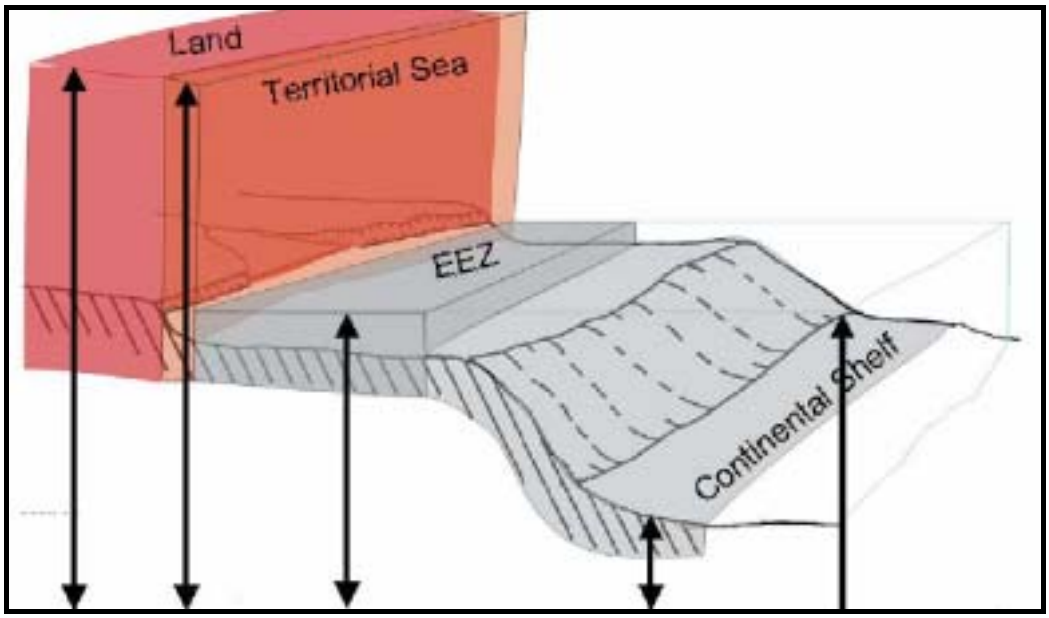
Regarding the argument for use of a cadastre concept in the marine environment, it is further supported by (Hoogsteden and Robertson 1998), *'If it is accepted that a legal cadastre is a very efficient method of identifying, recording and protecting all interests in "land" in a state, then the extension and evolution of the land-based cadastre to the maritime environment is not only sensible but necessary for commercial progress.'*

For the purposes of this report, a marine cadastre will be defined as: *"A system to enable the boundaries of maritime rights and interests to be recorded, spatially managed and physically defined in relationship to the boundaries of other neighbouring or underlying rights and interests."* (Williamson, Leach et al. 2001)

If a marine cadastre is to have a holistic integrated approach, then it follows that it will have to hold a wide range of interest. This could include shipping lanes, geophysical exploration, oil and gas extraction, defence issues, fisheries and conservation.

> *"Issues that need to be considered are the administrative governance, regulatory structures and service delivery mechanisms, marine resource planning and environment effects management, and the establishment of an appropriate spatial information infrastructure."*
>
> (Robertson, Benwell et al. 1999)

UNCLOS may have a profound influence on how the offshore parcel is defined. This influence will be seen by not only how a nation draws limits but also specifies the depths or layers at which rights begin and cease (Cockburn, Nichols et al. 2003). Below is a diagram that shows the UNCLOS zones and the specific associated depths.



(Cockburn, Nichols et al. 2003)

Figure 8.1 – UNCLOS zones and spatial rights.

In short, UNCLOS will influence both the total depth and breadth of a nation's marine cadastre, and the breadth and depth of certain individual zones within that cadastre. The concept of cadastral depth is more complex in the marine environment than it is on land (Cockburn, Nichols et al. 2003).

8.1.2 Definition

The word 'cadastre' is not common in the English language and rarely recognised by a person without surveying or land administration knowledge. However even within the group of people who use it on a daily bases it can have different meanings. In some case a 'cadastre' is a map, while in others it is a register of rights and interests; historically always in land. Consequently it can avoid misunderstanding if the term is expanded to the type of cadastre: fiscal cadastre, juridical cadastre, multipurpose cadastre, etc. This does not however help avoid confusion over the use of the term marine cadastre.

In 2003, there was a joint University of New Brunswick and FIG Meeting on Marine Cadastre Issues. The meeting set out to debate some of the fundamental marine cadastre issues. One such issue was the definition of the term 'marine cadastre'. The delegates from Australia offered two definitions of a marine cadastre in one of their presentations.

1. Marine cadastre is a system to enable the boundaries of maritime rights and interests to be recorded, spatially managed and physically defined in relationship to the boundaries of other neighbouring or underlying rights and interests
2. It is a marine information system, encompassing both the nature and spatial extent of the interests and property rights, with respect to ownership, various rights and responsibilities in the marine jurisdiction

They further pointed out that because the term 'marine cadastre' is relatively new there is freedom to refine the term to include 'multipurpose'.

8.1.3 Land Cadastre Principles

Some of the first work in the developing the concept of a cadastre for the marine environment, were to evaluate if land cadastre principles could simply be applied to the marine environment, which was a common thought and reaction (Collier, 2001). However in a report by Collier et al, for the 42nd Australia Surveyors Congress, a number of unique problems were identified that were posed by the marine environment. This included:

- The concept of *tenure* does not exist at sea
- It is not possible to use classical means of boundary demarcation offshore
- The marine environment is three dimensional – classical 2D simplifications will not suffice
- It is possible (common) for multiple (overlapping) rights to exist in a single locality
- Rights can vary with time, adding a fourth dimension to the spatial data
- The baseline to which many maritime boundaries are related is ambulatory

8.1.4 3D Cadastre

Historically cadastral systems have only primarily dealt with land as two-dimensional parcels. However recently there has been a growing awareness that there is a necessity

for a cadastral solution for multilayer construction (Benhamu and Doytsher 2002). There is significant research in this field, while not specifically directed towards the marine environment, the applications opportunities are obvious. As mentioned earlier, there would be a requirement of a marine cadastre to have a minimum three dimensions. Jantien Stoter evaluates the Danish 3D cadastre situation in section 4.3 of her work.

The future cadastre will form fully comprehensive, methodical and updated documentation of private and public rights, ownership, land use and restrictions applicable to real estate in the various spaces. The 3D cadastre will determine the location of the parcel in space and its 3D boundaries and serve the legal and physical objectives, while also being utilized for basic mapping, planning land use and spatial environmental planning (Benhamu and Doytsher 2002).

8.1.5 Multipurpose Cadastre

Cadastral models have developed from simple fiscal cadastres for taxation purposes to complex juridical cadastres supporting land markets. However the development of the land based cadastral system will always be limited to changing the existing system. Consequently the creation of a marine cadastre brings excitement with it as it will not be constrained by historical factors.

UNCLOS allocates rights, restrictions and responsibilities with spatial components to the marine environment, thus creating a ‘complex multidimensional mosaic of potential private and public interests’ (Ng'ang'a, Nichols et al. 2001). Without any institutional or pre-existing cadastral system, when creating a marine cadastre apart from the legal interests, biological, socio-cultural, economic and other thematic layers can be included in the cadastre to give it a multipurpose function.

Ng'ang'a et al, identifies two steps in achieving this multipurpose marine cadastre linking to the fundamental concept of what are the two key components of a cadastre: textual and spatial. The first is a ‘complete understanding’ of the interests represented in the marine cadastral parcel. This is very complex due to the differing nature of marine interest needing to consider marine resource data, terrestrial data, scientific data as well as any other information associated with interests. The second step

addresses the spatial component, defining the marine cadastral parcel. Due to the nature of marine interest it would be essential that this new parcel be three-dimensional to ensure it can handle all marine interest in the subsoil, seabed, water column, surface and air. Further a four-dimensional would also be necessary to address the 'time' nature of interest. For example, many fishing rights are limited to particular times of the year.

8.1.6 Registration of Marine Interests

Problems inhibiting the development of improved spatial capacities of marine interest include 'highly formal and differentiated legal authorizations, relative precision of spatial identification, overlapping responsibilities and a leadership vacuum' (Wallace and Williamson 2004). Wallace et al discusses issues related to the design of a 'dual purpose' and 'integrated approach' to marine registration. Dual purpose, as it will not only register of interests for legal security but also for better management. Wallace further agues that registers create wealth by creating order out of disorder of assets and allocation of resources. The management of the marine environment is characterised by many individual management systems, which with out integration cannot deliver 'comprehensive sustainable marine management'. This is very true in Denmark, with individual management systems and registers for petroleum and gas licences, fishing license, wind turbine rights, harbours and infrastructure and environmental conservation.

However while registries and cadastres are essential for private property regimes and property markets, this is not a driving factor necessarily in the marine environment and with marine cadastres. While a marine cadastre could create such property markets in some countries, this would not be the case in Denmark. In Denmark there are not private property rights to the marine environment. The State holds all rights to the marine environment from the High Water Mark to the EEZ boundaries. Consequently the registration of Danish marine interest would not be for private ownership but rather management of licences and leases. This would not be without benefits, looking to functions of managing private property regimes for evidence. Wallace et al identifies four functions: 1) Separation, 2) Layering, 3) Administration and 4) Informed policy making.

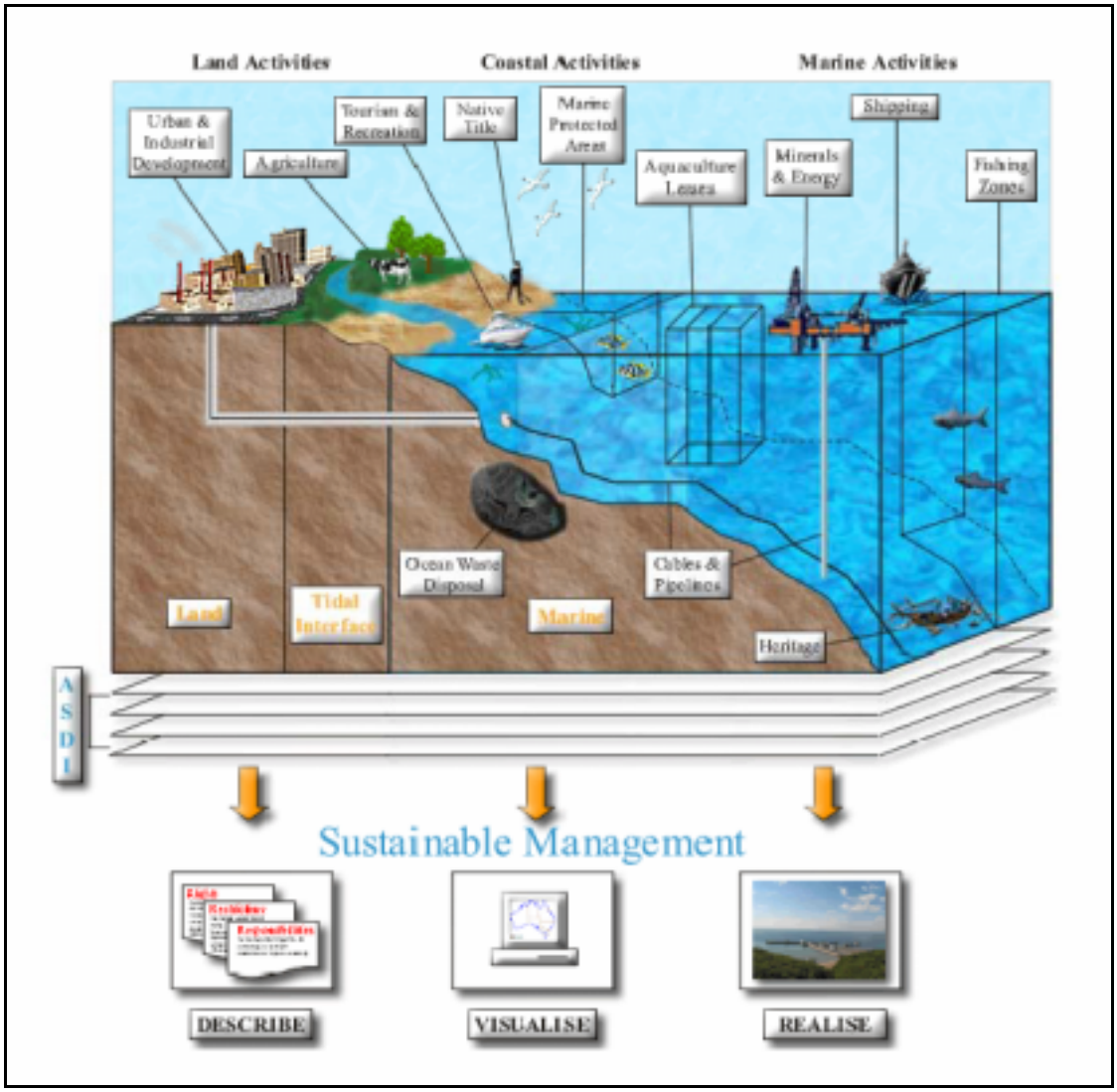
Separation would help differentiate and identify *every* commodity, being it licence, lease or other, assigning a unique textual and spatial component. Layering helps recognise overlapping and competing interest of commodities sand activities within the same area. Administration gives and allows for a holistic approach and view of all resources. Finally as an overarching function of the three previously function, policy making would be enhanced with sectors and at a national level due to better information and complete information.

8.2 Spatial Data Infrastructure

It is clear that since 1992, sustainable development principles are the new agenda for society around the world. Also in the 1990s, the advancement of information and communication technology (ICT) has played an important role in helping realise sustainable development goals. Spatial Data Infrastructure (SDI) is seen as a part of ICT. Spatial data are items of information that can be related to a location on the Earth (Rajabifard 2002). Consequently, spatial data infrastructure encompasses the resources, systems, network linkages, standards and institutional issues (Delavar, Rajabifard et al. 2003). The development of most SDI initiatives throughout the world has focused almost entirely on land (Williamson, Rajabifard et al. 2004). But more recently with development of a marine cadastre concept as to has the idea of a marine SDI.

The need for a marine component to SDIs is increasing, being driven mainly by the need to address environmental, economic and social issues of sustainable development, along with the need to break down data silos, creating easier access to accurate and up-to-date spatial data (Williamson, Rajabifard et al. 2004)

A marine cadastre would comprise of only one (fundamental underpinning) part of a marine SDI. Below is the Australian Marine Cadastre concept diagram. From this diagram, it can be seen that cadastral information is part of the ASDI. Further more the ASDI helps build towards sustainable management and which can then be ‘described, visualised and realised’ through ICT.

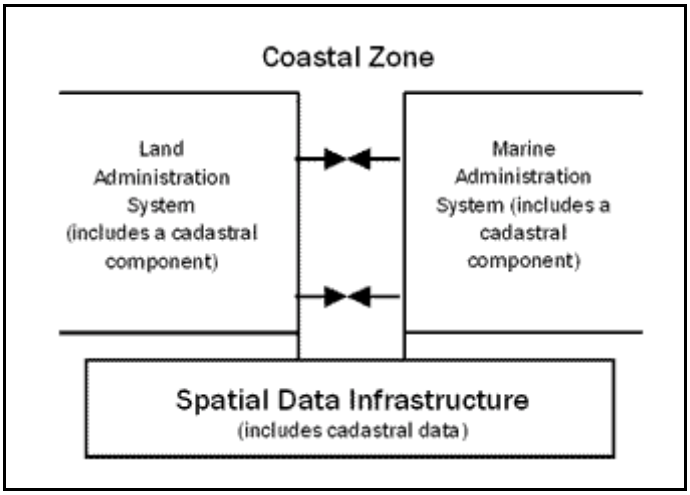


(Binns, Rajabifard et al. 2003)

Figure 8.2 – Screen shot of Australian Marine Cadastre diagram

8.3 Land – Sea Interface

As marine management initiatives are being developed, a key issue is how to address the land – sea interface (coastal zone). How this coastal zone is treated may very well relate to how successful a system is. It is imperative that access to and interoperability of spatial data that relates to the land and marine environments (Strain, 2004). If land administration systems and marine administration systems are built and operated separately, it would deepen the gap between the two systems (Strain, 2004. This would in turn make coastal management harder with the lack of compete, assessable and update information.



(Strain, Rajabifard et al. 2004)

Figure 8.3 – Seamless administration

8.4 Policy

Policy-makers would no doubt benefit from an understanding of the upper and lower bounds of the exploration rights, and how these may affect the environment or other property entitlements within the same parcel (Ng'ang'a, Sutherland et al. 2001).

In the United States, President Bush established by Executive Order a Cabinet-level "Committee on Ocean Policy" to coordinate the activities of executive branch departments and agencies regarding ocean-related matters in an integrated and effective manner to advance the environmental and economic interests of present and future generations of Americans, in December 2004.

In July 2000, the New Zealand Cabinet agreed to the development of an Oceans Policy for New Zealand. The policy would ensure integrated and consistent management of the oceans within New Zealand's jurisdiction. Development of the policy would be a cross-government exercise, covering all aspects of oceans management, including effects from land, and would extend out to the edge of the Exclusive Economic Zone and the Continental Shelf beyond.

Australia's Oceans Policy was launched in December 1998 to manage 16 million square kilometres of oceans between 3 and 200 nautical miles from the coast - Australia's Exclusive Economic Zone. The Policy recognises the need to maintain the oceans ecosystem health. It also recognises that the promotion of strong, diverse and

internationally competitive marine industries so important to national and regional economies depends on the long-term ecological sustainability of a wide range of ocean uses. With so much at stake, Australia's oceans need to be managed.

Canada's Oceans Act passed in 1997, Fisheries and Oceans Canada made a commitment to develop a new approach to managing our oceans. An important part of this legislation has been the introduction of three principles - sustainable development, integrated management, and precautionary approach - which we must strive to uphold. One of the Department's responsibilities under the Oceans Act has been to develop a National Oceans Strategy that provides an overall strategic approach to oceans management. Click here to find out more about Canada's Oceans Strategy.

The main incentive for coastal management policy in Denmark has been the control of coastal erosion, the need for a balanced utilisation of resources in the coastal zone and the wish to enhance the environmental quality of the coastal zone. In addition to this, rights of way, general setback lines, and governmental sovereignty over the sea territory are pillars in Danish coastal policy (Barneveld, Sprink et al. 2004). However this is only coastal policy and does not extend to the EEZ boundaries.

Currently in the exploitation of natural resources, the use of the seabed for construction e.g. harbours, wind mill farms, transmission systems for communication and energy, shipping routes for high speed ferries and coastal protection are regulated according to a number of different laws. Also there is an increasing pressure especially in the coastal waters between nature protection interests and a number of commercial interests e.g. fisheries, raw material extraction, wind mill farms, transmission systems etc. and initiatives are taken to establish spatial management systems for the utilization of the sea (Barneveld, Sprink et al. 2004).

Following the lead from other countries and identifying the need in Denmark, a Oceans policy seems a logical and necessary step in achieving holistic management. Further evidence comes from the EU Marine Strategy task force highlights a strong case for Europe to look at ocean affairs in a more coordinated way. It can be seen that a similar justification can be used at a national level, "*the particular need for an all-embracing maritime policy aimed at developing a thriving maritime economy and the*

full potential of sea-based activity in an environmentally sustainable manner" (Strategic Objectives of the Commission for 2005-2009).

8.5 Conclusion

It is becoming accepted that applying cadastral principles to the marine environment, is an excellent way of storing information about interests in the marine environment. However land cadastre principles can not be directly applied, with a marine cadastre concept provide several unique problems, like three and four-dimensional parcels, boundary delimitation, different types of interest and marine tenure issues. A marine cadastre is also seen as only one part of an integrated holistic management system for the marine environment. It was shown that like on the land a marine cadastre should be part of a marine SDI. Particular attention is focus towards interoperability with the terrestrial SDI and the coastal zone, where both systems connect.

9 ANALYSIS

The intension of this Chapter is to address the second aim of the thesis; *to identify challenges, barriers and benefits in adopting or implementing a new marine management system*. This was achieved by setting three objectives in that gathered the require information. This information can be founding the three preceding Chapters. This Chapter will use the information to answer the aim.

9.1 Challenges

In Part One of this thesis, a need was identified for a new marine management system. To address this need, there are challenges that will have to be overcome in proceeding forward and implementing measures to address the need. Below are some key areas that that can be seen as challenges.

Institutional – Although the Ministry of Environment is responsibly for integrated management of the marine environment, in practice this is spread over many authorities and institution from several different Ministries. While this is not necessarily a negative characteristic of the Denmark's current marine management system, it does however mean that there is a constant on-going challenge to ensure communication between authorities. If at any point the coordinating mechanism being interagency and a Ministerial Working Group, fails then there is no integration at all between sectors. This would in turn have an adverse affect on the numerous internal and external

Policy – Currently there is no marine or oceans policy in Denmark. This means that while different sectors are working together, they do not have one strategy to move forward. Each sector as well as (internal and external) organisations have their own policies, however some of these stakeholder fundamentally have conflicting objectives. An oceans policy would have an umbrella for all sectors and stakeholders to work under. In light of the currently development of an EU Marine Strategy, it seems appropriate and necessary to develop policy that address the many internal and external influencing factors.

Approach – If or when the problem is addressed, one of the first fundamental questions that will need to be answer is, *should there be two separate systems for land and water or one seamless system?* How this is answer will determine the needs of the system and consequently the methods used. While this probably would not affected the management of the EEZ, it does have significant influence on the coastal zone. At the moment, generally speaking, there land and marine environment are treated separately. There are however some exceptions, for example the DEA currently manages its spatial data in a seamless manner as seen in Figure 7.2 – Oil and Gas area in Denmark.

Coastal Zone – All ready identified as a critical area, in the cases studies (Chapter 3) and in cadastral models and framework (Chapter 8), this component is very important. Key challenges with this land-sea interface are to ensure, efficient and effective systems in place. Regardless of the approach to either use seamless or two separate land and marine systems, the challenges is to make certain that no area is neglected or having dual administration. This is not only in relation to legislation, which currently does have some 'grey' areas in Denmark, but also in relation to data. Currently coastal management is good in Denmark with open dialogue between many stakeholders, programs that integrated all aspects of coastal management and thorough planning schemes. However it will be important that when the governmental restructures occurs, changing from three to two levels of government, it is important that the responsibilities currently held by the counties are not left and reassigned to state or municipal authorities.

Interoperability – The new marine management concept also stresses the need to create a framework that is compatible with its land-based counterpart and built upon the principles of the NSDI (Binns, Rajabifard et al. 2004). This conceptual need can be further expanding in the Danish context to also highlight the need for regional interoperability. In many of the regional influencing factors, large marine ecosystems (LME) are the bases of boundaries. LME concept takes into consideration that pollution and marine life do not respect state boundaries, thus regions are created biological and bathymetric boundaries. In addition to LME, sometimes Danish authorise have the power and authority outside national jurisdiction. An example of this is fishing rights and the Bonn Agreements. Both have boundaries (as seen in

Figure 6.1 – Bonn Agreement Surveillance Zones and Appendix E – ICES Fishing Areas).

9.2 Barriers

Denmark is a country proud of its history and culture but also its ability to change and adapted to the latest trends and initiatives. This has made is a world leader in many fields including environment conservation and shipping. However, though it currently has a good system of management in the marine environment, there are still barriers for it to continue to move forward.

Institutional – Primarily due to historical reasons, the current institutional and processes within the marine environment are complex. While there is degree of integration within the coastal zone, there is very little in the territorial seas and EEZ. These complex and sectored institutional arrangements, while not a full barrier, they would definitely hinder the process by the need to coordinate efforts with so many different authorities.

Knowledge – There is some research in the field of ICZM, however there is a distinct lack of work beyond the coastal zone, incorporating the entire Danish marine territories. This means that there is little knowledge at the moment to build from. With this knowledge barrier comes a lack of work collating the evidence and benefits for implementing a new system.

Political – A programme to design and implement a new marine management system would require a lot of time and money. While it should include private sector input, it would be primarily a public sector project. Consequently, for such a project to be initiated, implemented and successful it would need significant high level involvement and political will.

9.3 Benefits

While considerable effort would be needed to implement a system that has been discussed, this would be with it rewards and be addressing an associated already identified need.

Decision Making – having both an 'integrated' and 'holistic' system to management the marine environment would allow for well founded, informative decisions. It would allow for not only quick decisive action in time of emergency, but also help make long term strategic decisions. For example, if there is a shipping accident, the response time is critical to minimising its effect. A system allowing users to visualise what interest are in the area would help decision where the first response efforts should be focused. A further example, in relation to fisheries management. If a fish nursery is affected by poor quality of the water, it may move. This in turn, this could affect fishing activities location, furthermore reduce the space available for recreational or overlay with shipping activity. Subsequently, an integrated system would help make decisions for the long term planning. Also building or extending of ports and marinas, the mooring of shellfish cages or the creation of wind turbine farms, all of them impact on each other and needs to be planned.

Proactive – by actively creating a new marine management system, this would allow authorities to identify issues before they became a problem. Identifying competing interest, would allow for measures to be taken if conflict was foreseeable. Also a system would allow Denmark to response to future initiatives. Like the EU Marine Strategy, if a system was in place minimal effort would have to be used to complete or fulfil its requirements.

Double Loop Learning – A new system created for the marine environment would not have historical constrains, which the current land administration system. This means that there is minimal are few constraints when designing the system. For example, a marine administration system could better designs 3D and multipurpose cadastres. In this way the land administration could benefit. Thus a marine administration system could change restrictive values and assumptions in the land administration system.

9.4 Conclusion

There are numerous challenges and barriers to overcome before for a new marine management system could be realised. Amongst others these include institutional and cultural factors. However if overcome there are benefits that would come from such an effort.

10 CONCLUSIONS

The intension of this Chapter is to evaluate how the research was achieved, assess the research aims and to give suggestions for areas of further research.

10.1 Evaluation

This research initially set up two aims, i) *to identify a need for a better marine management system in Denmark,* and ii) *to identify challenges, barriers and benefits in adopting or implementing a new marine management system*. An initial problem stated was formulated to address the first aim, with three objectives assumptions were confirmed. This formed the first part of this research. The confirmation of these assumptions proves that there is a new global agenda, countries are currently addressing this new agenda and there is a need for it to be addressed in Denmark.

After assumptions where supported in the first part of the research, a second problem statement was formulated. This problem statement was formulated to address the second aim of the research. Once again three objectives where created to solve the problem statement. From the second part of the research it was found that there is a multitude of influencing factors in the marine environment. These factors come both internally from Denmark as well as externally. Generally stakeholders have a vested interest in one particular aspect of the marine environment. Further it was shown that concept of a marine cadastre could form a fundamental layer of marine SDI or NSDI, as part of a framework that would coordinate the spatial dimensions of marine management. This cadastre could help register rights and interest in the marine environment.

Finally this leaves the research with a key questions, *would the benefits of such a system be outweigh the cost of overcoming the challengers and barriers?* With the originally assumptions for the need confirm in the first part and the challenges, barriers and benefits identified in the second part, it seems like the answers is yes. However this is an initial answer based on a generalised study. For the answer to be answered more accurately, the cost of a specific approach, model and method of implementation would have to be investigated.

10.2 Future Research

One difficult aspect of this research was the lack of previous research in the Danish context to build on and refer to. While some research has been done on Danish coastal management, it does not extend offshore. There is a definite need for more research in the field of integrated holistic marine management for Denmark. While there are many institutional, technical and legal aspects that could be researched, in reference to the spatial dimensions of marine management, some key questions are:

- What would a Danish marine cadastre look like?
- Should a *seamless* approach be taken to land and marine management?
- How might a marine SDI, fit into the NSDI?

10.3 Future Perspective

The need for change is recognised within the private and public sectors. As a result of this recognition, there are currently initiatives addressing problems within the management of the Danish marine environment. However none of these initiatives have a holistic approach, usually concentrating on shipping, fishing, pollution, the environment or another area within the marine environment. For such an initiative to be created it will have to come from the state level of government. As well as having governmental willingness, it also would need a strong political resolve to ensure the initiative is seen through and result in real benefits.

REFERENCES

This references list includes sources directly refereed within the report as well as other material that was used throughout the thesis.

Ahuja, B. (2000). "Legal, political, technical and commercial issues of Land Information Systems." GISdevelopment.net.

Anker, H. T. (1998). "Integrated Coastal Zone Management in Denmark: ways and means for further integration." Transnational Seminar on the European Spatial Development Perspective.

Anker, H. T., V. Nellemann, et al. (2003). Integrated Coastal Zone Mangement in Denmark. Rights and Duties in the Coastal Zone, Stockholm.

Bailey, P. (2000). "Discourse and the Regulation of the Environment and Technology: Overfishing and Vessel Monitoring in European Fisheries." Institute for Fisheries Management.

Banica, A., J. Bastard, et al. (2003). "Integrated Coastal Zone Management (ICZM): a framework to tackle environmental issues? Danish Approach."

Barneveld, R. v., N. Sprink, et al. (2004). "Coastal Management in Denmark." EUCC - The Coastal Union (commissioned by HELCOM HABITAT).

Barry, M., I. Elema, et al. (2002). "Ocean Governance and the Marine Cadastre: The Netherlands North Sea."

Barry, M., I. Elema, et al. (2003). "Ocean Governance in the Netherlands North Sea." FIG Working Week 2003.

Benhamu, M. and Y. Doytsher (2002). "A Multilayer 3D Cadastre: Problems and Solutions."

Binns, A. (2004). Defining a Marine Cadastre: Legal and Institutional Aspects. Department of Geomatics. Melbourne, The University of Melbourne.

Binns, A., A. Rajabifard, et al. (2003). "Issues in Defining the Concept of a Marine Cadastre for Australia."

Binns, A., A. Rajabifard, et al. (2004). "Developing the Concept of a Marine Cadastre: An Australian Case Study."

Binns, A. and I. Williamson (2003). "Building a National Marine Initiative through the Development of a Marine Cadastre for Australia." East Asia Seas Congress 2003: National Coastal and Ocean Policies and Strategies.

Bittner, S. and A. Frank (1997). "A formal model of correctness in a cadastre."

Bjornsson, C. (2004). "Cadastre 2014 – From Vision to GIS."

Brazenor, C., C. Ogleby, et al. (1999). "The Spatial Dimension of Aboriginal Land Tenure."

Brodersen, H. J. (2004). "Green Wishes to Standardisation." Danish Society for the Conservation of Nature.

Brown, C. (1999). Investigation of the necessary components of a 500 year cadastre. The Graduate School. Salem, Massachusetts, Salem State College.

Cockburn, S. and S. Nichols (2002). "Effects of the Law on the Marine Cadastre: Title, Administration, Jurisdiction, and Canada's Outer Limit."

Cockburn, S., S. Nichols, et al. (2003). "UNCLOS' potential influence on a marine cadastre: depth, breadth, and sovereign rights."

Collier, P., F. Leahy, et al. (2001). "Defining a Marine Cadastre for Australia." A Spatial Odyssey: 42nd Australian Surveyors.

Collier, P., B. Murphy, et al. (2002). "The Automated Delimitation of Maritime Boundaries: An Australian Perspective."

Collier, P., P. Todd, et al. (2003). "First Steps Towards an Australian Marine Cadastre."

CSD (1997). "Danish Country Profile." 5th Session of the Commission on Sustainable Development.

CSD (2002). "Denmark Country Profile." Johannesburg Summit 2002.

DAF (2004). Danish Armed Forces - International Perspective.

DCA (2002). "Information." The Danish Coastal Authority.

DEA (2003). "Oil and Gas Production in Denmark 2003." Danish Energy Authority.

DEA (2004). "Energy policy statement 2004." Danish Energy Authority.

DEA (2004). "A Guide to Hydrocarbon Licences in Denmark." Danish Energy Authority.

Degnbol, P. (2002). "The ecosystem approach and fisheries management institutions: the noble art of addressing complexity and uncertainty with all onboard and on a budget." Institute for Fisheries Management and Coastal Community Development.

Degnbol, P., A. Carlberg, et al. (2003). "Integrating fisheries and environmental policies." The Nordic Council of Ministers Nordic Strategy for the Environment and Fisheries.

Degnbol, P., D. Wilson, et al. (2003). Spatial Scale in Coastal Zone Management:Current Approaches, Challenges and Possibilities. Rights and Duties in the Coastal Zone, Stockholm.

Delavar, M., A. Rajabifard, et al. (2003). "NSDI and IT Evolution."

Döring, R. (2001). "Concepts of Sustainable Fisheries." Botanical Institute University of Greifswald.

EEA (2004). "EEA strategy 2004–2008." European Envrionemental Agency.

EPA (2000). "Arctic Marine Pollution: Proposals for Nordic Initiatives."

EU (1994). Europe 2000+ Cooperation for European territorial development, European Commission; Office for Official Publications of the European Communities, 2 rue Mercier, L-2985 Luxembourg.

EU (2001). "Ten years after Rio: Preparing for the World Summit on Sustainable Development in 2002." Communication from the Comission on the Councile and European Parliment **COM(2001) 53 final**.

EU (2002). "implementation of Integrated Coastal Zone Management in Europe." Official Journal of the European Communities **1**(48): 24-27.

EU (2003). "The World Summit on Sustainable Development one year on: implementing our commitments." Communication from the Comission on the Councile and European Parliment **COM(2003) 829 final**.

EU (2005). "The 2005 Review of the EU Sustainable Development Strategy: Initial Stocktaking and Future Orientations." Communication from the Comission on the Councile and European Parliment **COM(2005) 37 final**.

FAO (2004). "Fishery Country Profile: Denmark." Food and Agriculture Organization of the United Nations.

FIG (2004). The Olympic Spirit in Surveying. FIG Working Week, Athens, Greece.

FIG (2005). From Pharaohs to Geoinformatics. FIG Working Week, Cairo, Egypt.

FIG (2005). Minutes. FIG 28th General Assembly, Cairo, Egypt.

Forse, J. and P. Collier (2003). "Assessing the need for an Australian Marine Cadastre."

Fowler, C. and E. Treml (2000). "Building a Marine Cadastral Information System for the United States - a case study." International Journal on Computers, Environment & Urban Systems Special Issues: Cadastral Systems.

Fraser, R. (2002). Implementing a Marine Cadastre: Boundary Positioning Issues and Logical Design Concepts. Department of Geomatics. Melbourne, Assessing the need for an Australian Marine Cadastre.

Fraser, R., P. Collier, et al. (2003). "Positioning Maritime Boundaries with Certainty: a rigorous approach."

Fraser, R., P. Todd, et al. (2003). "Issues in the Development of a Marine Cadastre."

Gillespie, R. (2001). "Marine Geospatial Data Infrastructure: The Key to Effective Exclusive Economic Zone Managment and Control."

Good, J., D. Sower, et al. (1999). Benefits of Geographic Information Systems for State and Regional Ocean Management, Coastal Services Center (National Oceanic and Atmospheric Administration).

Greenpeace (1997). "Integration of Fisheries and Environmental Issues." North Sea Interim Ministerial Meeting (IMM) on the Integration of Fisheries and Environmental Issues.

Hansen, K. V. (2005). "Danish Cadastre System." National Survey and Cadastre.

HELCOM (2002). "Implementation of HELCOM Recommendations in Denmark." Sea-based Pollution Group (HELCOM SEA) Fifth Meeting.

HELCOM (2003). "The Baltic Marine Environment 1999–2002." Helsinki Commission (Baltic Sea Environment Proceedings No. 87).

HELCOM (2005). "HELCOME News." 2/2005 Newsletter.

Hirst, B. and D. Robertson (2001). "Law of the sea boundaries in a marine cadastre."

Hoogsteden, C. and W. Robertson (1998). On Land - Off Shore: Strategic issues in building a seamless cadastre for New Zealand. Developing the Profession in a Developing World, XXI International Congress.

ICES (2001). "Compilation of Submitted Inputs (Fisheries - Part II Status of North Sea Fish Stocks)." Progress Report to the Fifth North Sea Conference.

IFM (2005). "Instituted for Fisheries Management and Coastal Cummunity Development."

IMO (2000). "The Key to Sustainable Maritime Development." the technical cooperation programme of teh International Maritime Organization.

Interreg (2004). "Project Development: Spatial Development." Interreg North Sea Region Programme.

Interreg (2005). "Interreg IIIB The North Sea Programme." Interreg IIIB The North Sea Programme.

Interreg (2005). "Key Facts of the North Sea Programme - status 2005." Interreg IIIB North Sea Programme.

James, T. (1999). "Cadastral Mapping: Will High-Resolution Imagery Impact Your Approach?"

Jia, B. (1997). "A Preliminary Study of the Problem of the Isle of Kolbeinsey."

Karimov, A. (1998). "State, Navy and the origin of petrine forest cadastre."

Kaufmann, J. (1998). Cadastre 2014 : a vision for a future cadastral system. Berne, Switzerland FIG, 1998.

KMS (2004). "Behind the naitical chart."

KMS (2004). "Introduction to KMS." Kort & Matrikelstyrelsen.

Knight, P. (2002). "Enclosure of the Tasman Sea, or establishing the Tasman Sea as a Common Pool Resource Domain?" Trans Tasman Surveyor **1**(3): 27-31.

Kock, C. (2004). Proliferation Security Initiative Global Container Line Security Workshop. Copenhagen, Danish Ministry of Foreign Affairs.

Kristensen, L. and J. Primdahl (2004). "Potential for environmental cross-compliance to advance agri-environment objectives." Danish Centre for Forest, Landscape and Planning, The Royal Veterinary and Agricultural University, Denmark.

Leahy, F., P. Collier, et al. (1996). "Algorithms for the intersection of complex maritime boundaries."

Leahy, F., B. Murphy, et al. (2001). "Uncertainty issues in the geodetic delimitation of maritime boundaries."

LIZN (1999). Principles for a SeabedCadastre. OSG Technical Report 9 - Office of the Surveyor-General, Land Information New Zealand.

LPA (2005). "Introduction to Local Agenda 21 in Denmark." Landsplanafdelingen.

Mærsk (2004). "Annual Report." A.P. Møller - Mærsk A/S.

MIM (2001). "Towards a Cleaner Marine Environment." Danish Ministry of Energy.

Mitchell, D., P. Collier, et al. (2001). "The United Nations Convention on the Law of the Sea and the Delimitation of Australia's Maritime Boundaries."

MMS (2004). "Implementation Plan For A Multipurpose Marine Cadastre." United States Department of the Interior (Minerals Management Service).

Monahan, D. (2003). "Mapping Implications for Canada Implications for Canada of ratifying Law of the Sea of ratifying Law of the Sea."

Monahan, D. (2005). "An investigation of the feasibility of making an early initial claim to part of Canada's juridical continental shelf under Article 76 of United Nations Convention on Law of the Sea (UNCLOS)."

Muggenhuber (2001). "Time and Space in Cadastre." Space and Time - GIS and Remote Sensing Conference.

Murphy, B., P. Collier, et al. (1999). "Maritime Zone Boundary Generation from Straight Baselines Defined as Geodesics."

Ng'ang'a, S., S. Nichols, et al. (2001). "Toward a Multidimensional Marine Cadastre in Support of Good Ocean Governance."

Ng'ang'a, S., M. Sutherland, et al. (2001). "Toward a 3D Marine Cadastre in Support of Good Ocean Governance."

Nichols, S., J. Hughes-Clarke, et al. (2001). "Defining the Marine Boundary Component of Candada's Geospatial Data Infrastucture (CGDI)."

Nichols, S. and D. Monahan (1999). Fuzzy boundaries in a sea of uncertainty: Canada's offshore boundaries. The Coastal Cadastre - Onland, Offshore, Bay of Islands, New Zealand.

Nichols, S. and M. Sutherland (2000). "Good Governance of Canada's Offshore and Coastal Zone: Towards an Understanding of the Marine Boundary Issues."

Nichols, S., M. Sutherland, et al. (2001). The Association of Canada Lands Surveyors (ACLS) Offshore Issues Consultation Workshop, Halifax, Nova Scotia.

Nielsen, J. R. (1997). "Danish cases with fisheries co-management." Institute for Fisheries Management & Coastal Community Development.

Nielsen, J. R. (2000). "Ethical, Legal and Social Aspects of Fisheries Management in Europe." Institute for Fisheries Management and Coastal Community Development.

NOAA (2001). "Ocean Planning Information System (OPIS) Project Protocol Manual."

NOO (2003). "Oceans Policy: Principles and Processes." National Oceans Office, Austalia.

PANOS (1995). "FISH: A NET LOSS FOR THE POOR: Developing countries and the impact of dwindling world fish stocks." Panos Media Briefing No.15.

Park, M. and I. Williamson (2002). "An Englishman looks at the Torrens System - another look 50 years on."

PCGIAP (2004). Administrating the Marine Environment: The Spatial Dimensions. International Workshop on. Kuala Lumpur, Malaysia, PCGIAP.

PPL (2004). "The Peace Palace Library Centennial Exhibition: The Law of the Sea." The Peace Palace Library, The Hague.

Rajabifard, A. (2002). Diffusion of Regional Spatial Data Infrastructures: with Particular Reference to Asia and the Pacific. Department of Geomatics. Melbourne, The University of Melbourne.

Rajabifard, A., P. Collier, et al. (2003). "Australian Marine Cadastre Research and Activities." FIG and University of New Brunswick Meeting on Marine Cadastre Issues September 15-16, 2003, University of New Brunswick, Canada.

Rajabifard, A., P. Collier, et al. (2004). "Marine SDI and Cadastre Activities in Asia-Pacific." Coastal Zone Asia Pacific (CZAP).

Rasmussen, G. and P. Geertz-Hansen (2001). "Fisheries management in inland and coastal waters in Denmark from 1987 to 1999." Fisheries Management and Ecology **8**: 311-322.

Reyntjens, D. and D. Wilson (2004). Conference Paper 5: Governance. Sustainable Fisheries: Facing the Environemntal Challenges, Brussels.

Robertson, B., G. Benwell, et al. (1999). "The Marine Resource: Administration Infrastructure Requirements." UN-FIG Conference on Land Tenure and Cadastral Infrastructures for Sustainable Development (Melbourne).

Roos, S. and K. Kromp (1994). "Coastal Ecosystems and Tourism." EUCC.

Rosemarin, A. (1996). Baltic 21: Creating an Agenda 21 for the Baltic Sea Region. Main report. Stockholm, Stockholm Environment Institute (SEI).

Schlagintweit, G. (2003). "The Road to a Marine Cadastre."

Soerensen, H. C., L. K. Hansen, et al. (2003). EXPERIENCE WITH AND STRATEGIES FOR PUBLIC INVOLVEMENT IN OFFSHORE WIND PROJECTS. National Planning Procedures for Offshore Wind Energy in the EU, Brussels, Belgium, Institute for Infrastructure, Environment and Innovation.

Soerensen, H. C., L. K. Hansen, et al. (2003). Conflicts of Interest. Copenhagen, European Thematic Network on Wave Energy.

SPD (1998). "Local Agenda 21 in Denmark State of implementation in late 1998." Ministry of Environment and Energy, Spatial Plannning Department.

Steudler, D., I. Williamson, et al. (2000). "BENCHMARKING CADASTRAL SYSTEMS." The Australian Surveyor **42**(3): 87-106.

Steudler, D., I. Williamson, et al. (2003). "The Development of a Cadastral Template."

Stoter, J. E. (2004). 3D cadastre. Delft, Nederlandse Commissie voor Geodesie.

Strain, L., A. Rajabifard, et al. (2004). "Spatial Data Infrastructure to Facilitate Coastal Zone Management."

Sutherland, M. (2003). The UNB-FIG Meeting on Marine Cadastre Issues. New Brunswick, Canada, University of New Brunswick.

Sutherland, M. (2005). "The Marine Cadastre: Legal and Spatial Data Contribution to Economic, Environmental and Social Development." TS 40 – FIG Commission 4 Working Group Activities.

Sutherland, M., S. Ng'ang'a, et al. (2001). "The Use of Spatial Fusion and WAP to Provide Support Information for Marine Environment Sustainability."

Sutherland, M. and S. Nichols (2004). "The evolving role of hydrography in ocean governance and the concept of a marine cadastre."

Tamtomo, J. (2003). "The Needs for Building Concept and Authorizing Implementation of Marine Cadastre in Indonesia."

Taussik, J., H. Smith, et al. (2002). "Management of the Territorial Sea." EUROCOAST / EUCC.

Tétreault, J.-C. (2001). "Canada's Maritime Cadastre."

TFG (2002). "Review of the Implementation of Oceans Policy."

Thormahlen, L., P. Rogers, et al. (2000). "Developing a Multipurpose Marine Cadastre From a Natural Resource Management Perspective A Practical Solution."

Ting, L. and I. Williamson (1999). "Cadastral Trends: A Synthesis." The Australian Surveyor **4**(1): 46-54.

Ting, L. and I. Williamson (2000). "Land Administration and Cadastral Trends: The Impact of the Changing Humankind-Land Relationship and Major Global Drivers."

Todd, P. (2001). "Marine Cadastre: Opportunities and implications for Queensland."

Tranaes, F. (2004). "Danish Wind Energy." Danish Wind Turbine Owners' Association.

Turner, K. (1999). "Integrating natural and socio-econmic science in coastal managment." **CSERGE Working Paper GEC 99-14**.

UN (1992). "Agenda 21." UN Department of Econimic and Social Affairs.

UN (2004). "Report of the 5th Global Meeting of the Regional Seas Concvention and Action Plans." UN Environmental Programme.

UN (2005). "Social and Economic Benefits of Good Land Administartion (2nd Ed.)." UN Economic Commission for Europe.

UNFPA (2004). "Statistics from State of World Population."

Valstad, T. (2003). "The Oslo Method - A practical approach to register 3D properties."

Wallace, J. and I. Williamson (2004). "Developing Cadastres to Service Complex Property Markets."

Wallace, J. and I. Williamson (2004). "Registration of Marine Interests."

Widodo, S. (2003). "The Needs for Marine Cadastre and Supports of Spatial Data Infrastructures in Marine Environment – A Case Study."

Widodo, S. (2005). "Developing a Marine Spatial Planning: Lessons from Integrated Spatial Plan for City of Balikpapan, Indonesia."

Widodo, S., J. Leach, et al. (2002). "Marine Cadastre and Spatial Data Infrastructure in Marine Environment." Joint AURISA and Institution of Surveyors Conference.

Williamson, I. (1995). Appropriate Cadastral Systems. Modern Cadastres and Cadastral Innovation, Technical University of Delft, The Netherlands, Commision 7, International Federation of Surveyors.

Williamson, I. (1996). "Appropriate Cadastral Systems." Agrimensura **2**(6): 20.

Williamson, I. (2001). "Re-engineering land administration systems for sustainable development – from

rhetoric to reality."

Williamson, I. (2002). "The Cadastral "Tool Box" – a Framework for Reform."

Williamson, I., A. Fauzi, et al. (2004). STATUS REPORT. For 10th PCGIAP meeting, Permanent Committee on GIS Infrastructure for Asia and the Pacific.

Williamson, I. and D. Grant (2000). "The United Nations - International Federation of Surveyors Declaration on Land Administration for Sustainable Development."

Williamson, I., J. Leach, et al. (2001). "Position Paper on Marine Cadastres." PCGIAP – Working Group on the Cadastre.

Williamson, I., A. Rajabifard, et al. (2004). "Issues in Developing Marine SDI." Centre for Spatial Data Infrastructures and Land Administration.

Wilson, D. (1998). "Bluefish Science in the Northeast Region: A Case Study." Institute for Fisheries Management and Coastal Community Development.

WWF (2002). "The European Marine Strategy." Briefing by WWF for Members of the European Parliment.

WWF (2003). "European Marine Strategy Briefing."

APPENDIX

This Chapter contains all the appendices:

- Interviewees
- Interview Material
- Maritime Boundary Delimitation Agreements
- ICES Fishing Areas
- Danish Maritime Convention
- International Maritime Conventions
- EU Legislation (and related documents on the marine environment)
- Report Structure
- Marine Danish Government Structure

A. Interviewees

Organisation	*Contact*	*Time and Date*
Landinspektørfirmaet Nellemann & Bjørnkjær Strandvejen 18 Aalborg	Mads Hvolby Surveyor	14-4-2005
Kort & Matrikelstyrelsen Rentemestervej 8 Copenhagen NV	Trine Heinemann Land surveyor Legal Center Lars Buhl Legal Advisor Legal Center Finn L. Møller Nautical Coordinator Hydrographic Division Jesper Møllgaard Hydrographic Adviser Hydrographic Division	13:00 11-5-2005
Danish Maritime Authority Vermundsgade 38C Copenhagen	Jesper Loldrup Head of Section Centre for Maritime Safety and Environmental Regulation	16:00 11-5-2005
Danish Energy Authority Amaliegade 44 Copenhagen K	Søren Frederiksen Senior Engineer Energy Resources Division	10:00 12-5-2005
Fisheries Directorate Nyrophstgade 30 Copenhagen	Søren Jensen Fiskerikontrollør	15:30 12-5-2005
Royal Danish Administration of Navigation and Hydrography Overgaden oven Vandet 62B Copenhagen K	John Woodward Section Leader - Data Administration Oceanographic Department	09:00 13-5-2005
Danish Forest and Nature Agency Harasdlgade Copenhagen	Ulrik Chr. Berggreen Marine Biologist Sea & Habitat division	11:00 13-5-2005
Kystdirektoratet Højbovej 1 Lemvig	Thorsten Piontkowitz Project Manager Coastal Engineering & Legal Division Inge Rasmussen Head of Section Coastal Engineering & Legal Division	10:30 18-5-2005

B. Interview Material

In addition to the below pages, a cover letter and the Marine Administration template were also attached.

Rationale

Australian Rationale

An Australian collaborative research project involving university and corporate partners, has been running since 2001. The objective was to 'provide a comprehensive spatial data infrastructure whereby rights restrictions and responsibilities in the marine environment can be assessed, administrated and managed'. To achieve this objective, it was acknowledged that first there was a need to identify and understand:

8. The role and impact of various levels of legislation and regulation
9. The rights, restrictions, responsibilities and requirements of the various players
10. The source and quality of data to be used in the spatial analysis and management

Once the knowledge base was built up, then the design and development of a marine cadastre to proceed.

Further information can be found at http://www.geom.unimelb.edu.au/maritime/

Q1: Could you please rank the in order of important the three objectives, if such a project was to occur in Denmark? Briefly explain why.

Canadian Rationale

During a similar project in Canada, Doug Culham, Deputy Surveyor General (East) opening remarks speaking on a 'The Need for Coordination' worskop, said, "We are here to talk about property rights in the offshore and the infrastructure required to support the various property systems."

The project outlined three key questions that should be answerable for a State to provide 'good ocean governance'. This questions should not only be answered but the answer should be 'complete, clear, and easily communicated'. The three questions where:

3. What resources, living and non-living, are there to govern?
4. Who holds the rights and responsibilities for their safe and orderly conservation, distribution, and exploitation?
5. What are the spatial limits (boundaries) of those rights and responsibilities?

The project focused on the last question. He saw the development of a Marine Geospatial Data Infrastructure (MGDI) as critical and that the layer of spatial limits provided as geo-referenced information on legal rights and responsibilities as fundamental. It was pointed out that few countries have this 'comprehensive inventory of these rights and boundaries'.

Further information can be found at http://gge.unb.ca/Research/OceanGov/

Q2: Are any of the three questions answered '*completely, clearly, and easily communicated*' in relation to Denmark? If so what agency holds the information? If no, which question do you think is the most important to answer in Denmark?

United States Rationale

In a key paper published in the International Journal on Computers, Environment & Urban Systems entitled 'Building A Marine Cadastral Information System For The United States – A Case Study' (2000), the concept of a marine cadastre in U.S. is explored. The authors, Fowler and Trenl, compare and contrast how land cadastral principles might be applied to the marine environment. They critically analyse the NOAA OPIS project, looking at how the project is achieving integrated marine management. They see a land cadastre as a government entity of geo-referencing legal descriptions of property rights. If this concept was transferred to the marine environment (once completed)they believe:

The ability to visualise property rights, regulations, laws, and management regimes can assist policy makers in understanding conflicts, revealing inconsistencies in national or state policy, educating or justifying boundary limits to the public, and providing a general organising structure to very complex data.

Further information can be found at http://gge.unb.ca/Research/OceanGov/

Q3: Do you agree when they say such a system could 'assist policy makers'?

Approaches

New Zealand – Seamless Cadastre Approach

In a report by Dr Morgan Williams, Parliamentary Commissioner for the Environment, entitled *Setting course for a sustainable future; the management of New Zealand's marine environment*, key issues and concerns were identified as to how New Zealand manages it marine environment.
While being constructive, the report identified a number of areas of concern.

- There is a lack of communication and a grave lack of trust among marine stakeholders that is severely inhibiting the advancement of sustainable management.
- New Zealand's lack of marine knowledge is a serious environmental and economic risk, and the willingness of Government to invest in attaining knowledge is crucial to achieving sustainable management.
- Current marine management structures are arbitrary, fragmented, and lacking a coherent overarching strategic focus that would integrate diverse interests and values.
- The current commercial fishing rights regime cannot by itself ensure sustainable management of fisheries and other marine resources.

Q4: Do you think these issues exist, if only in part, in Denmark?

Chris Hoogsteden for the FIG XXI International Congress: Commission 7, Cadastre and Land Management, explores issues in a New Zealand context. The paper analysis the New Zealand situation of marine management and identifies the need, benefits and challenges ahead. Hoogsteden recommendations and approach is focused around the formation, or rather an extension and application of terrestrial cadastre principles to the marine environment.

"If it is accepted that a legal cadastre is a very efficient method of identifying, recording and protecting all interests in "land" in a state, then the extension and evolution of the land-based cadastre to the maritime environment is not only sensible but necessary for commercial progress."(Hoogsteden 1998)

Q5: Is this argument appropriate for Denmark current situation?

The paper continues and suggests three models for implementation of a 'on land – off shore' cadastre: incremental, sectoral and seamless models. The report defines the seabed cadastre as:

A system to enable the boundaries of seabed rights and interests, to be recorded, spatially managed and physically defined in relationship to the boundaries of other neighbouring or underlying rights and interests.

In developing the most suitable strategy for developing an efficient form of property and user rights to territorial sea and ocean areas it is useful to consider the possible scenarios for implementation.

The Incremental Model – This model involves adapting incrementally to changes demands and opportunities as they occur.
The Sectoral Model – This would involve the provision of a spatial infrastructure specifically for sectors as they were evidently needed.
The Seamless Cadastral Model – This model draws from the concept of the National Spatial Data Infrastructure (NSDI) but fully encompasses the offshore territorial area and accepts a variability of the application of the NSDI framework and its format for the maritime environment.

The full paper and further explanations of the models can be found at http://www.sli.unimelb.edu.au/fig7/Brighton98/Comm7Papers/TS3-Hoogsteden.html

Q6: Would any (or none) of these models been appropriate given a Danish context?

Netherlands – Regional Cooperation approach

In a paper presented in Paris 2003, during a FIG Working week by Michael Barry analyses the situation in The Netherlands. Unlike previous cases, this case study has a much more complex political and historical context.

The North Sea is one of the most heavily used and divided seas in the world. Eight countries have sovereign coastline around the North Sea with a further four, part of the North Sea catchment. Barry points out that due to this complex political

atmosphere, “it is necessary to debate policies, management strategies, laws, permits and other similar instruments at regular intervals at international, ministerial and operational level to achieve an integrated system of cooperative governance”.

It is pointed out that institutions such as the Committee of North Sea Senior Officials (CONSSO) a regional body are integral to the successful long term governance and management.

Q7: How highly would you rate regional cooperation as a successful part of national management of the Danish marine environment?

The Netherlands has an agency called Interdepartmental Coordinating Committee for North Sea Affairs (ICONA). This is the primary institution in terms of coordination of governance and policy formulation at a national level. It consists of ten different agencies from 6 Ministries. ICONA coordinates resource management and national policies but does not delivery service functions.

Q8: Would a similar agency be benefit to Denmark?

C. Maritime Boundary Delimitation Agreements

Canada
17 December 1973 Agreement between the Government of the Kingdom of Denmark and the Government of Canada relating to the delimitation of the continental shelf between Greenland and Canada (with annexes)

Germany
9 June 1965 Agreement (with Protocol) between the Kingdom of Denmark and the Federal Republic of Germany concerning the delimitation, in the coastal regions, of the continental shelf of the North Sea
9 June 1965 Protocol to the Agreement between the Kingdom of Denmark and the Federal Republic of Germany concerning the delimitation, in the coastal regions, of the continental shelf of the North Sea
2 February 1967 * Special agreement for the submission to the International Court of Justice of a difference between the Kingdom of Denmark and the Federal Republic of Germany concerning the delimitation, as between the Kingdom of Denmark and the Federal Republic of Germany of the continental shelf in the North Sea,
22 and 28 October 1970 Exchange of notes constituting an agreement concerning the delimitation of the borderline between Denmark and the Federal Republic of Germany in the Flensborg Fiord area
25 August 1971 (Flensburg) and 14 September 1971 (Abenra) Supplementary Protocol to the Exchange of notes constituting an agreement concerning the delimitation of the borderline between Denmark and the Federal Republic of Germany in the Flensborg Fiord area
28 January 1971 Treaty between the Kingdom of Denmark and the Federal Republic of Germany concerning the delimitation of the continental shelf under the North Sea (with annexes and exchange of letters)
14 September 1988 Treaty between the German Democratic Republic and the Kingdom of Denmark on the Delimitation of the Continental Shelf and the Fishery Zones

Germany and Netherlands
28 January 1971 Protocol to the Treaties of 28 January 1971 between the Federal Republic of Germany and Denmark and the Kingdom of the Netherlands, respectively, concerning the delimitation of the continental shelf under the North Sea.

Iceland
11 November 1997 Agreement between the Government of the Kingdom of Denmark along with the Local Government of Greenland on the one hand, and the Government of the Republic of Iceland on the other hand on the Delimitation of the Continental Shelf and the Fishery Zone in the Area between Greenland and Iceland

Netherlands
31 March 1966 Agreement between the Government of the Kingdom of the Netherlands and the Government of the Kingdom of Denmark concerning the delimitation of the continental shelf under the North Sea between the two countries

Norway
8 December 1965 Agreement between Denmark and Norway relating to the delimitation of the continental shelf,
24 April 1968 Agreement between Denmark and Norway relating to the delimitation of the continental shelf, 8 December 1965 - Exchange of notes constituting an agreement amending the above-mentioned Agreement. Copenhagen,
4 June 1974 Agreement between Denmark and Norway relating to the delimitation of the continental shelf, 8 December 1965 - Exchange of notes constituting an agreement amending the above-mentioned Agreement,

15 June 1979 Agreement between the Government of the Kingdom of Denmark and the Government of the Kingdom of Norway concerning the delimitation of the continental shelf in the area between the Faroe Islands and Norway and concerning the boundary between the fishery zone near the Faroe Islands and the Norwegian economic zone
18 December 1995 Agreement between the Kingdom of Denmark and the Kingdom of Norway concerning the delimitation of the continental shelf in the area between Jan Mayen and Greenland and concerning the boundary between the fishery zones in the area
11 November 1997 Additional Protocol to the Agreement of 18 December 1995 between the Kingdom of Norway and the Kingdom of Denmark on the Delimitation of the Continental Shelf in the Area between Jan Mayen and Greenland and the Boundary between Fishery Zones in the Area,

Sweden
,25 June 1979 Exchange of notes constituting an agreement between Denmark and Sweden concerning the delimitation of the territorial waters between Denmark and Sweden
9 November 1984 Agreement between Sweden and Denmark on the delimitation of the continental shelf and fishing zones (with map, exchanges of notes and Protocol)
21 November 1986 Exchange of notes constituting an agreement between Denmark and Sweden concerning the delimitation of areas of responsibility in connection with the Convention of 22 March 1974 on the protection of the Marine Environment of the Baltic Sea Area

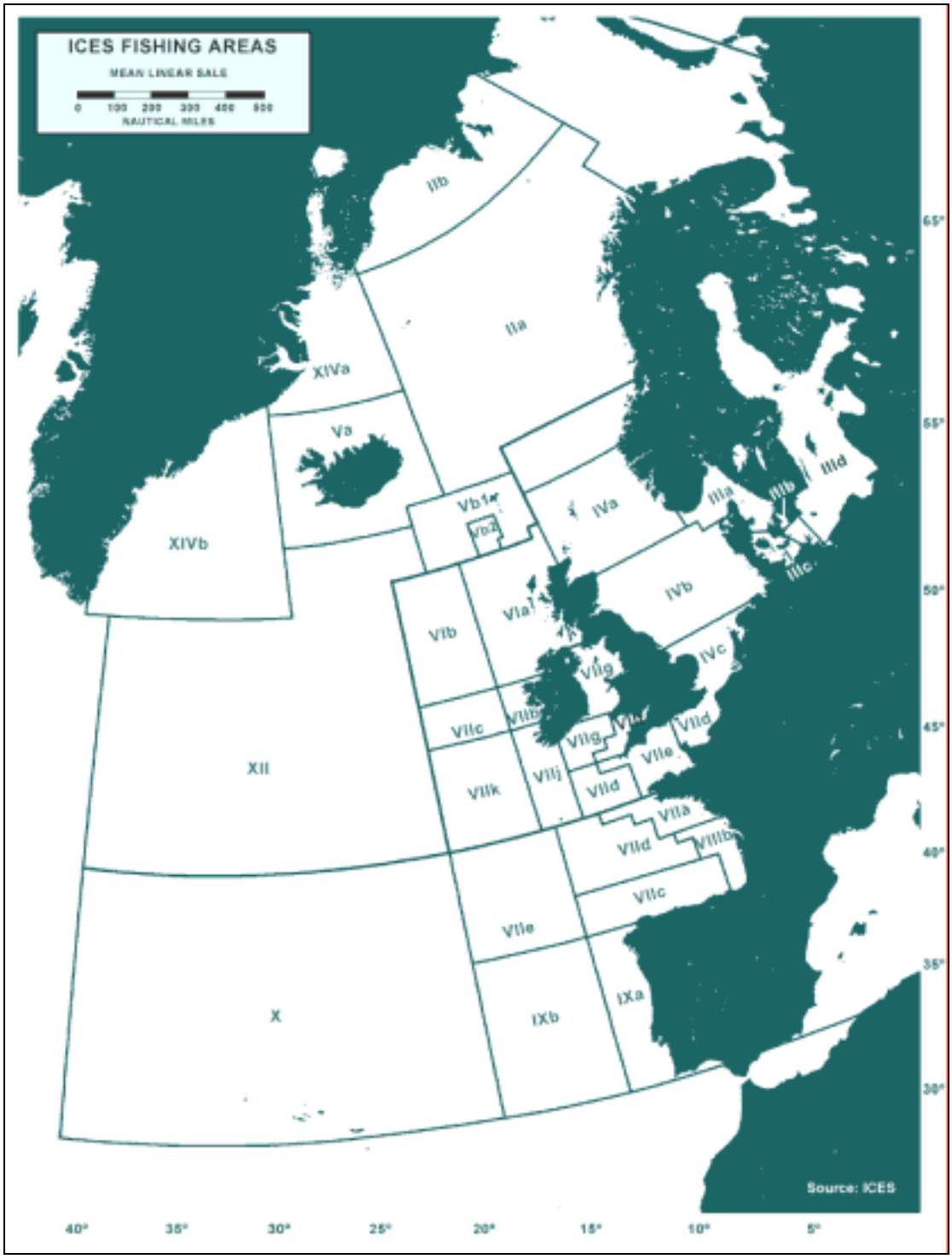
United Kingdom of Great Britain and Northern Ireland
3 March 1966 Agreement between the Government of the United Kingdom of Great Britain and Northern Ireland and the Government of the Kingdom of Denmark relating to the delimitation of the continental shelf between the two countries,
25 November 1971 Agreement between the Government of the Kingdom of Denmark and the Government of the United Kingdom of Great Britain and Northern Ireland relating to the delimitation of the continental shelf between the two countries,
18 May 1999 Agreement between the Government of the Kingdom of Denmark together with the Home Government of the Faroe Islands, on the one hand, and the Government of the United Kingdom of Great Britain and Northern Ireland, on the other hand, relating to Maritime Delimitation in the Area between the Faroe Islands and the United Kingdom,

International Court of Justice
Denmark - Germany
20 February 1969 Special agreement for the submission to the international court of justice of a difference between the Kingdom of Denmark and the Federal Republic of Germany concerning the delimitation, as between the Kingdom of Denmark and the Federal Republic of Germany of the continental shelf in the North Sea

Denmark - Norway
14 June 1993 Case concerning the maritime delimitation in the area between Greenland and Jan Mayen (Denmark, Norway)

Source: UN (Division for Ocean Affairs and the Law of the Sea)

D. ICES Fishing Areas



Source: ICES

E. Danish Maritime Convention

X	IMO Convention 48
X	IMO amendments 91
X	IMO amendments 93
X	SOLAS Convention 74
X	SOLAS Protocol 78
X	SOLAS Protocol 88
X	Stockholm Agreement 96
X	LOAD LINES Convention 66
X	LOAD LINES Protocol 88
x	TONNAGE Convention 69
x	COLREG Convention 72
x	CSC Convention 72
	CSC amendments 93
x	SFV Protocol 93
x	STCW Convention 78
x	STCW-F Convention 95
x	SAR Convention 79
	STP Agreement 71
	STP Protocol 73
x	INMARSAT Convention 76
x	INMARSAT OA 76
x	INMARSAT amendments 94
x	INMARSAT amendments 98
x	FACILITATION Convention 65
x	MARPOL 73/78 (Annex I/II)
x	MARPOL 73/78 (Annex III)
x	MARPOL 73/78 (Annex IV)
x	MARPOL 73/78 (Annex V)
x	MARPOL Protocol 97 (Annex VI)

x	London Convention 72
x	London Convention Protocol 96
x	INTERVENTION Convention 69
x	INTERVENTION Protocol 73
d	CLC Convention 69
x	CLC Protocol 76
x	CLC Protocol 92
d	FUND Convention 71
x	FUND Protocol 76
x	FUND Protocol 92
x	FUND Protocol 2003
x	NUCLEAR Convention 71
	PAL Convention 74
	PAL Protocol 76
	PAL Protocol 90
	PAL Protocol 02
d	LLMC Convention 76
x	LLMC Protocol 96
x	SUA Convention 88
x	SUA Protocol 88
x	SALVAGE Convention 89
x	OPRC Convention 90
	HNS Convention 96
	OPRC/HNS 2000
	BUNKERS CONVENTION 01
x	ANTI FOULING 01

Source: International Maritime Organization

F. International Maritime Conventions

Maritime safety

- International Convention for the Safety of Life at Sea (SOLAS), 1974
- International Convention on Load Lines (LL), 1966
- Special Trade Passenger Ships Agreement (STP), 1971
- Protocol on Space Requirements for Special Trade Passenger Ships, 1973
- Convention on the International Regulations for Preventing Collisions at Sea (COLREG), 1972
- International Convention for Safe Containers (CSC), 1972
- Convention on the International Maritime Satellite Organization (INMARSAT), 1976
- The Torremolinos International Convention for the Safety of Fishing Vessels (SFV), 1977
- International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW), 1978
- International Convention on Standards of Training, Certification and Watchkeeping for Fishing Vessel Personnel (STCW-F), 1995
- International Convention on Maritime Search and Rescue (SAR), 1979

Marine pollution

- International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto (MARPOL 73/78)
- International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties (INTERVENTION), 1969
- Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (LDC), 1972
- International Convention on Oil Pollution Preparedness, Response and Co-operation (OPRC), 1990
- Protocol on Preparedness, Response and Co-operation to pollution Incidents by Hazardous and Noxious Substances, 2000 (HNS Protocol)
- International Convention on the Control of Harmful Anti-fouling Systems on Ships (AFS), 2001
- International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004

Liability and compensation

- International Convention on Civil Liability for Oil Pollution Damage (CLC), 1969
- International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage (FUND), 1971
- Convention relating to Civil Liability in the Field of Maritime Carriage of Nuclear Material (NUCLEAR), 1971
- Athens Convention relating to the Carriage of Passengers and their Luggage by Sea (PAL), 1974
- Convention on Limitation of Liability for Maritime Claims (LLMC), 1976

- International Convention on Liability and Compensation for Damage in Connection with the Carriage of Hazardous and Noxious Substances by Sea (HNS), 1996
- International Convention on Civil Liability for Bunker Oil Pollution Damage, 2001

Other subjects

- Convention on Facilitation of International Maritime Traffic (FAL), 1965
- International Convention on Tonnage Measurement of Ships (TONNAGE), 1969
- Convention for the Suppression of Unlawful Acts Against the Safety of Maritime Navigation (SUA), 1988
- International Convention on Salvage (SALVAGE), 1989

Source: International Maritime Organization

G. EU Legislation (and related documents on the marine environment)

Biodiversity Decline/ Habitat Destruction

- Agricultural Policy (CAP)
- Council Regulation (EC) No 2371/2002 of 20 December 2002 on the conservation and sustainable exploitation of fisheries resources under the Common Fisheries Policy
- Council Directive 79/409/EEC of 2 April 1979 on the conservation of wild birds (Birds Directive)
- Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (Habitats Directive)
- Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy (WFD)
- Recommendation of the European Parliament and of the Council of 30 May 2002 concerning the implementation of Integrated Coastal Zone Management in Europe (ICZM)
- Directive 2003/44/EC of the European Parliament and of the Council of 16 June 2003 amending Directive 94/25/EC on the approximation of the laws, regulations and administrative provisions of the Member States relating to recreational craft
- A Sustainable Europe for a Better World: A European Union Strategy for Sustainable Development (SDS)

Hazardous Substances

- Council Directive 67/548/EEC of 27 June 1967 on the approximation of laws, regulations and administrative provisions relating to the classification, packaging and labelling of dangerous substances, (a major amendment has been proposed by the REACH package)
- Council Directive 76/464/EEC of 4 May 1976 on pollution caused by certain dangerous substances discharged into the aquatic environment of the Community (plus daughter directives)
- Council Directive 76/769/EEC of 27 July 1976 on the approximation of the laws, regulations and administrative provisions of the Member States relating to restrictions on the marketing and use of certain dangerous substances and preparations
- Council Directive 91/414/EEC of 15 July 1991 concerning the placing of plant protection products on the market,
- Directive 98/8/EC of the European Parliament and of the Council of 16 February 1998 concerning the placing of biocidal products on the market
- Council Directive 96/61/EC of 24 September 1996 concerning integrated pollution prevention and control (IPPC)
- Water Framework Directive
- Proposal for a Regulation of the European Parliament and of the Council concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), establishing a European Chemicals Agency and amending Directive 1999/45/EC and Regulation (EC) {on Persistent Organic Pollutants}
- Proposal for a Directive of the European Parliament and of the Council amending Council Directive 67/548/EEC in order to adapt it to Regulation (EC) of the European Parliament and of the Council concerning the registration, evaluation, authorisation and restriction of chemicals
- Emissions legislation especially national emission ceilings

Eutrophication

- Council Directive 91/676/EEC of 12 December 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources (Nitrates Directive), ·
- Council Directive 91/271/EEC of 21 May 1991 concerning urban waste-water treatment (91/271, UWWT)

- Agricultural Policy (CAP)
- Water Framework Directive
- Emissions legislation especially national emission ceilings

Chronic Oil Pollution
- Directive on port reception facilities for ship-generated waste and cargo residues (2000/59)
- Community Framework for cooperation in the field of accidental or deliberate marine pollution

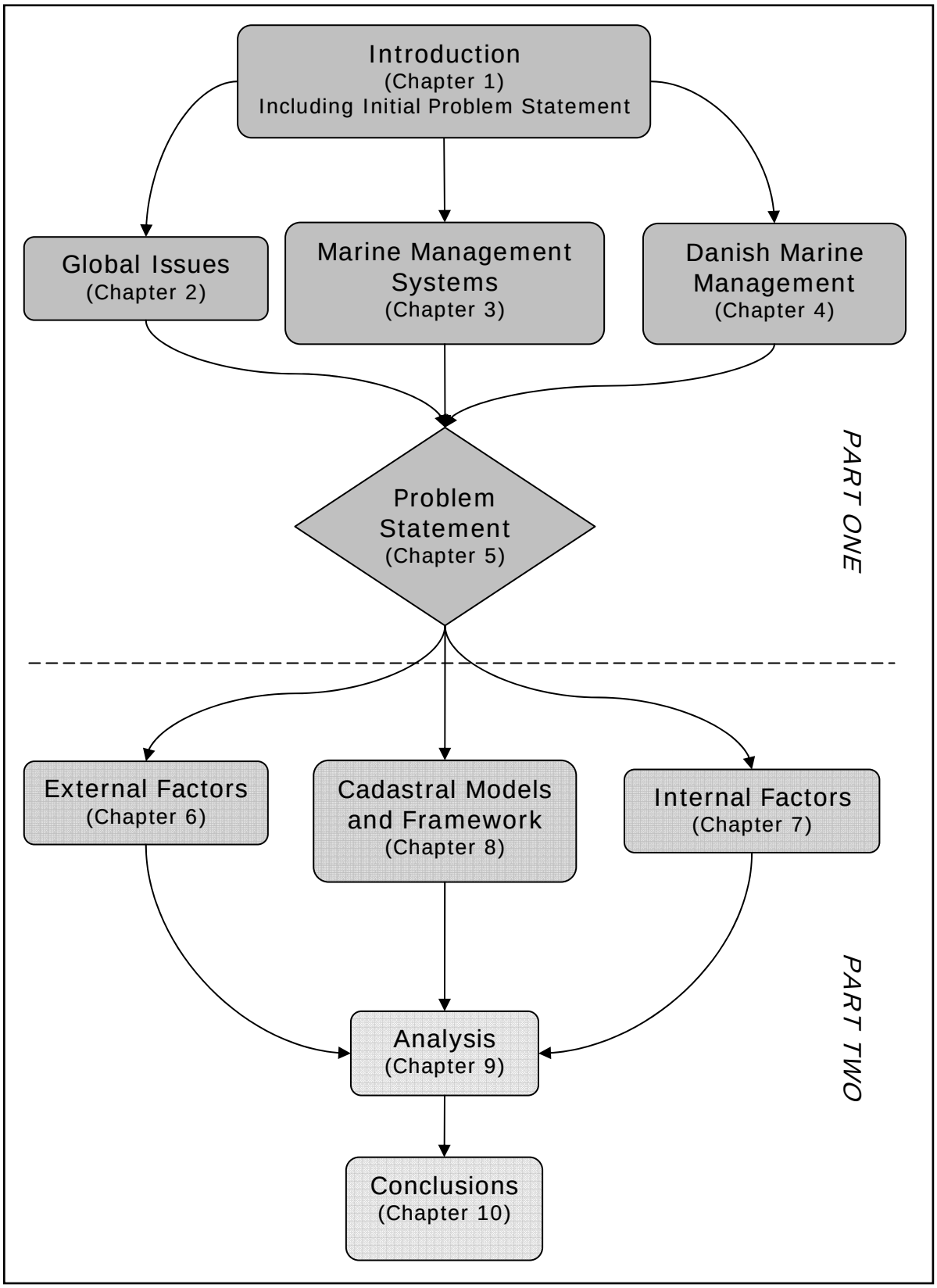
Radionuclides
- Basic safety standards established under the Euratom Treaty establishing the European Atomic Energy Community

Health and Environment
- Council Directive 76/160/EEC of 8 December 1975 concerning the quality of bathing water
- Urban Waste-Water Treatment
- Council Directive 91/492/EEC of 15 July 1991 laying down the health conditions for the production and the placing on the market of live bivalve molluscs
- Council Directive 91/493/EEC of 22 July 1991 laying down the health conditions for the production and the placing on the market of fishery products
- Council Directive 96/23/EC of 29 April 1996 on measures to monitor certain substances and residues thereof in live animals and animal products and repealing Directives 85/358/EEC and 86/469/EEC and Decisions 89/187/EEC and 91/664/EEC)
- Directive 2003/44/EC of the European Parliament and of the Council of 16 June 2003 amending Directive 94/25/EC on the approximation of the laws, regulations and administrative provisions of the Member States relating to recreational craft
- Proposal for a directive on the Protection of the Environment through Criminal Law (COM (2001) 139)

Maritime Transport (limited to measures most directly linked to the protection of the marine environment)
- Council Directive 93/75/EEC of 13 September 1993 concerning minimum requirements for vessels bound for or leaving Community ports and carrying dangerous or polluting goods (as amended by Directive 2002/84/EC)·
- Council Directive 94/57/EC of 22 November 1994 on common rules and standards for ship inspection and survey organizations and for the relevant activities of maritime administrations (as amended by Directive 2002/84/EC)·
- Council Directive 95/21/EC of 19 June 1995 concerning the enforcement, in respect of shipping using Community ports and sailing in the waters under the jurisdiction of the Member States, of international standards for ship safety, pollution prevention and shipboard living and working conditions (as amended by Directive 2002/84/EC)
- 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 (as amended by Directive 2002/84/EC)
- Directive 2001/25/EC of the European Parliament and of the Council of 4 April 2001 on the minimum level of training of seafarers (as amended by Directive 2002/84/EC)
- Directive 2002/84/EC of the European Parliament and of the Council of 5 November 2002 amending the Directives on maritime safety and the prevention of pollution from ships
- Regulation (EC) No 417/2002 of the European Parliament and of the Council of 18 February 2002 on the accelerated phasing-in of double hull or equivalent design requirements for single hull oil tankers and repealing Council Regulation (EC) No 2978/94

Source: EurOcean (http://www.eurocean.org/)

H. Report Structure



I. Marine Danish Government Structure