MARINE CADASTRES AND THE LAW: USING MODERN DEVELOPMENTS IN MARINE BOUNDARY LAW TO CONSTRUCT A LEGAL FRAMEWORK FOR OFFSHORE AND COASTAL SPACES

SARA COCKBURN

April 2005

TECHNICAL REPORT
NO. 228

MARINE CADASTRES AND THE LAW: USING MODERN DEVELOPMENTS IN MARINE BOUDARY LAW TO CONSTRUCT A LEGAL FRAMEWORK FOR OFFSHORE AND COASTAL SPACES

Sara Cockburn

Department of Geodesy and Geomatics Engineering
University of New Brunswick
P.O. Box 4400
Fredericton, N.B.
Canada
E3B 5A3

April 2005

PREFACE

This technical report is a reproduction of a thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in Engineering in the Department of Geodesy and Geomatics Engineering, April 2005. The research was supervised by Dr. Sue Nichols, and it was financially supported by the Natural Sciences and Engineering Research Council of Canada.

As with any copyrighted material, permission to reprint or quote extensively from this report must be received from the author. The citation to this work should appear as follows:

Cockburn, S. (2005). *Developments in Marine Boundary Law to Construct a Legal Framework for Offshore and Coastal Spaces.* M.Sc.E. thesis, Department of Geodesy and Geomatics Engineering Technical Report No. 228, University of New Brunswick, Fredericton, New Brunswick, Canada, 132 pp.

DEDICATION

This thesis is dedicated to my grandmother, Helen Grace Cockburn.

ABSTRACT

There are several problems facing those who work with marine boundaries on a daily basis. First, new law is emerging in an attempt to cope with an emerging set of marine resource and boundary issues.

Second, there are a wide variety of ocean boundary types, but marine rights are not usually tied to a parcel, and are generally held in unbundled form, unlike the traditional "bundle of sticks" view of land tenure.

Third, there are many marine areas where boundaries are insufficiently defined from a legal perspective should a conflict arise.

The objectives of this thesis are to (1) examine case studies from recent major sources of law including international convention, regional legislation, and arbitration panel decisions to determine common threads affecting those working with marine boundaries; and (2) develop a legal framework that may be used to test the essential ways in which law and policy affect this work.

ACKNOWLEDGEMENTS

I wish to thank my supervisor, Dr. Susan Nichols, B.Sc., M.Eng., Ph.D.; P.Eng; Professor and Director of Graduate Studies, Department of Geodesy and Geomatics Engineering, for giving me the opportunity to do this work and for all her help and advice throughout my time at UNB. I also wish to thank the other members of my Committee: Mr. Dave Monahan, B.Sc., M.A., M.Sc.E.; Hydrographer-in-Residence and Adjunct Professor; and Dr. Ian Methven, B.Sc.F. , Ph.D.; Director of the Centre for Property Studies, and Professor and Dean Emeritus; for their support and help throughout my studies at UNB and through this process.

I would also like to express my gratitude to Dr. David Coleman, B.Sc.E., M.Sc.E., Ph.D.; P.Eng., Professor and Dean of Engineering; Dr. David Wells, B.Sc., B.A.Sc., M.A.Sc., Ph.D.; P.Eng. and Professor Emeritus; Dr. Kevin Pegler, B.Tech., M.Eng., Ph.D.; P.Eng. and Term Assistant Professor; for their continuing encouragement and assistance; and to the entire faculty in the Department of Geodesy and Geomatics Engineering for their support and for helping to make my time in the Department such an enjoyable experience.

Others have also greatly contributed to my time at UNB as co-authors and friends. I would like to express my gratitude to those not mentioned above: Michael Sutherland and Sam Ng'ang'a, colleagues and friends; Ted McDorman, Professor of Law at the University of Victoria, for his support and mentorship during my stay at UVic; Anne LaForest, Professor of Law at UNB, for her support and mentorship in the Faculty of Law; and Dave Fraser, Mapping Technologist in GGE, for encouraging me to apply for my current position.

I also wish to acknowledge the Administrative Staff of the Department of Geodesy and Geomatics Engineering, whose assistance throughout my studies at UNB has been invaluable and much appreciated: Sylvia Whitaker, Linda O'Brien, Wendy Wells, Kim Delorey, and Tracy Hawco.

For funding support and many great opportunities including travel, I wish to gratefully acknowledge the Geomatics for Informed Decisions (GEOIDE) Network of Centres of Excellence, based at Université Laval.

For their support during the last two years, I also wish to thank all the management and staff at CARIS.

In conclusion, I wish to extend my gratitude to all my family and friends for their support throughout my years at UNB.

TABLE OF CONTENTS

DEDICATION ii
ACKNOWLEDGEMENTS iv
TABLE OF CONTENTS v
LIST OF TABLES ix
LIST OF FIGURES x
1: INTRODUCTION 1
1.1 The Development of Marine Boundary Law 2
1.2 Definitions 3
1.2.1 Marine Boundaries 3
1.2.2 Surveyor 3
1.2.3 Spatial Information Management 4
1.2.4 Technological and Methodological Use 5
1.2.5 Administration of Property Interests 5
1.3 Emerging Marine Boundary Problems 7
1.3.1 New Law 7
1.3.2 Diversity of Boundary Types 8
1.3.3 Insufficient Boundary Definition 8
1.4 Research Objectives and Methodology 9
1.5 Research Contributions and Thesis Organization 11
1.5.1 Research Contributions 11
1.5.2 Thesis Organization 12
CHAPTER 1 REFERENCES 13
ADMINISTRATION, JURISDICTION, AND CANADA'S OUTER LIMIT 14
2.1 The Cadastral Concept in the Marine Environment 14
2.2 The Law, Property Interests, and the Marine Cadastre: An Argument for 3D Visualization 15
2.2.1 Land-based vs. Water-based Property Interests 15
2.3 The Basics of a Legal Framework for a Marine Cadastre 16
2.3.1 Rights and Boundary Types in a Marine Cadastre 17
2.3.2 Government Interests and Types of Law in a Marine Cadastre 18
2.3.2.1 Government interests 18
2.3.2.1 Types of Law 21
2.3.3 Hierarchy of Laws and Rights 21
2.3.4 The Marine Cadastre Legal Framework: Conclusions 22
2.4 The Marine Cadastre Case Study: Development of a Hypothesis 23
2.4.1 Developing a Tripartite Argument 24
2.4.2 The Hypothesis 26
2.5 Issues With This Case Study 27
2.6 How to Test the Hypothesis 27
CHAPTER 2 REFERENCES 29
3: CASE STUDY II: UNCLOS AND THE OUTER LIMIT OF THE EXTENDED CONTINENTAL SHELF 33

3.1 The Selection of the UNCLOS Case Study....33
3.2 The UNCLOS Case Study....34
1. Introduction: the Changing Face of Technological Influences on Policy....34
2. Burden of Proof....37
A) Is there a burden of proof that a coastal State has to meet in order to pass the Commission's scrutiny?....37
3. Hierarchies of Evidence in the Guidelines of the Commission on the Limits of the Continental Shelf....42
A) In what ways did the accuracy and precision of various technologies influence these hierarchies?....42
B) How much of a role does data density play in these hierarchies of evidence?....43
C) In what ways do the hierarchies of evidence preferred by the Commission influence the technology used to make a claim?....43
D) Are the hierarchies of evidence outlined in the Commission Guidelines effective, or does it depend on the goal of the claiming State?....44
4. Canada's Orphan Knoll: A Specific Example....45
A) What data currently exists on Canada's Orphan Knoll? (A preliminary look.)....45
B) Could the current data fulfill the hierarchies of evidence articulated by the Commission?....47
5. Technical Expertise in a Legal Framework....49
A) How do the Commission's actions (those of a technical body) intertwine with the law?....49
6) Conclusion....50
3.3 Testing UNCLOS in the Hypothesized Legal Framework....51
3.3.1 UNCLOS Article 76 and the Administration of Property Interests....51
3.3.1.1 UNCLOS' Influence on the Governance and Administration of Property Interests....51
3.3.1.2 The UNCLOS Case Study Alters the Hypothesized Framework as to Governance and Administration of Property Interests....52
3.3.1.3 Historical Development of Continental Shelf Governance and Administration....53
3.3.1.4 UNCLOS Article 76: A New Framework Arrow Required....54
3.4 UNCLOS Article 76 and the Use of Technology and Methodology....55
3.4.1 UNCLOS' Influence on the Use of Technology and Methodology....55
3.4.2 The UNCLOS Case Study Alters the Hypothesized Framework as to Technological and Methodological Use....56
3.5 UNCLOS Article 76's Influence on the Management of Spatial Information....58
3.5.1 UNCLOS' Influence on the Management of Spatial Information....58
3.5.2 The Influence of Desired Spatial Information Management Practices on the CLCS....59
CHAPTER 3 REFERENCES....61

4: CASE STUDY III: THE NEWFOUNDLAND & LABRADOR – NOVA SCOTIA BOUNDARY ARBITRATION 64
4.1 The Selection of the NFLD – NS Boundary Arbitration Case Study 64
4.2 The Case: Its History and Development 64
4.2.1 The History of the Dispute 65
4.2.1.1 The Atlantic Provinces Inter-Provincial Boundaries in 1964 65
4.2.1.2 Newfoundland Seeks Clarification: Results of Part 1 of the Arbitration 67
4.2.1.3 The Atlantic Accords 67
4.3 The Decisions and Reasoning of the Tribunal 68
4.2.1 Stage 1 Results and Reasoning 69
4.2.2 Stage 2 Results and Reasoning 69
4.2.2.1 Newfoundland's Conduct 69
4.2.2.2 The Geneva Convention 70
4.2.2.3 Relative Wealth Considerations 71
4.2.2.4 Geographic Considerations 71
4.2.2.5 Final Delimitation and the Final Effect of Sable Island 72
4.4 Conclusions & Points of Interest for the Surveyor 74
4.5 The Newfoundland & Labrador – Nova Scotia Arbitration's Effect on the Hypothesized Legal Framework 75
4.4.1 The Arbitration and Administration and Governance of Property Interests 75
4.4.2 The Arbitration and Technological and Methodological Use 76
4.4.3 The Arbitration and Information Management 78
CHAPTER 4 REFERENCES 80
5: CASE STUDY IV: NEW BRUNSWICK'S COASTAL AREAS PROTECTION POLICY 82
5.1 The Selection of the Coastal Areas Protection Policy Case Study 82
5.2 Coastal Lands Protection: A Historical Perspective 82
5.2.1 Coastal Water Law, Generally 82
5.2.1.1 Private vs. Crown Ownership Along the Coast: Ambulatory Boundaries 82
5.2.1.2 Private vs. Crown Ownership Along the Coast: Accretion and Erosion 85
5.2.1.3 Private vs. Public Rights Along the Coast: When Can the Public Use My Beach? 86
5.2.1.4 Private Rights Along the Coast: How Can Upland Owners Protect Themselves? 87
5.3 The Elements of the Coastal Zone Policy as it Exists Today 88
5.3.1 Zone A: Coastal Lands Core Area 88
5.3.2 Zone B: Coastal Lands Buffer Area 89
5.3.3 Zone C: Coastal Transition Area 91
5.4 The Erosion Doctrine and the Proposed Coastal Areas Protection Policy 92
5.5 The Coastal Areas Protection Policy Case Study's Effect on the Hypothesized Legal Framework 93
5.5.1 The Coastal Areas Protection Policy and Administration and Governance of Property Interests, and Technological and Methodological Use 93
5.5.2 The CAPPNB and Information Management 94

5.6 Issues With the Coastal Areas Protection Policy Case Study 94
CHAPTER 5 REFERENCES 97
6: CASE STUDY V: UNCLOS' POTENTIAL INFLUENCE ON A MARINE CADASTRE: DEPTH, BREADTH, AND SOVEREIGN RIGHTS 98
6. 1 Revisiting UNCLOS and the Marine Cadastre 98
6.2 Cadastres Historically 98
6.2.1 Land and Marine Cadastre Development 98
6.2.2 Marine Cadastre Definitions 100
6.3 Global Model of the Land-Based Cadastre 101
6.4 A Parcel-Based Record and UNCLOS: Breadth and Depth 102
6.5 Interests in land : UNCLOS and Sovereign Rights 105
6.6 Encompassing the Nature and Extent of These Interests: UNCLOS and Boundary Evidence 107
6.7 Conclusions Regarding the Influence of UNCLOS on a Marine Cadastre 109
6.8 The UNCLOS and the Marine Cadastre Case Study's Effect on the Hypothesized Legal Framework 109
6.8.1 The Administration and Governance of Property Interests 109
6.8.2 Technological and Methodological Use 110
6.8.3 Information Management 111
6.8.4 Reverse Effects 111
CHAPTER 6 REFERENCES 113
7: CONCLUSIONS AND RECOMMENDATIONS 116
7.2 Conclusions 116
7.1 Recommendations 118
7.1.1 Using the Framework 118
7.1.2 Further Research 119
REFERENCES 121
CURRICULUM VITAE

LIST OF TABLES

2.1 after Monahan and Wells, 2001. Showing the range of uncertainty in the location of the various components of Article 76. 40
4.1 – Current Orphan Knoll Data Pertinent to a continental shelf claim 47
4.2 – Data Types Allowed in § 4.2 v. Current Orphan Knoll Data 48
4.3 – Data Types Allowed in § 5.2 v. Current Orphan Knoll Data 48
4.4 – Data Types Allowed in § 8.2 v. Current Orphan Knoll Data 49

LIST OF FIGURES

1.1: Ocean Governance from a Property Rights Perspective [from Nichols, et. al, 2000]..6
2.1: How government rights affect the marine cadastre. 19
2.2: Canada's framework for organizing human-interactive types of boundaries. 20
2.3: Marine Cadastre law could affect these areas. 26
2.4: The hypothesized Legal Framework for spatial work in a marine environment..... 26
3.1: (Figure 4.1 in original publication) – Map showing the position of Orphan Knoll ... 46
3.2: The additional administration arrow after the UNCLOS Case Study 54
3.3: The Framework after the UNCLOS Case Study, Part I 55
3.4: The additional technology arrow after the UNCLOS Case Study. 57
3.5: The Framework after the UNCLOS Case Study, Part II. 58
3.6: The additional information management arrow after the UNCLOS Case Study. 60
3.7: The Framework after the UNCLOS Case Study, Part III 60
4.1: The Framework for the Newfoundland – Nova Scotia Case Study 78
4.2: The Framework after the Newfoundland – Nova Scotia Arbitration Case Study 79
5.1: The Framework for the Coastal Areas Protection Policy for New Brunswick 95
5.2: The Framework after the Coastal Areas Protection Policy for New Brunswick Case Study 96
6.1: Black arrows illustrate the vertical extent of a Nation's sovereign rights in the specified UNCLOS zones. Right hand arrow points to the water surface. 102
6.2: The Framework for the UNCLOS-Marine Cadastre Case Study 110
6.3: The Legal Framework for spatial work in offshore and coastal environments. 112

1: INTRODUCTION

This thesis' hypothesis is that marine and water boundary laws affect those who work with spatial information in a coastal and offshore environment[1] in three principal ways: they affect the management and governance of property rights, restrictions, and responsibilities; the use of established and emergent technologies and methodologies; and the management of spatial information; and that these can be tested by the construction of a fundamental legal framework for the use in coastal and offshore environments. The hypothesis was arrived at following research on a potential legal framework for a marine cadastre, and will be tested using four other case studies. In all, this thesis will examine four new developments in ocean law and policy in order to test the hypothesis and build a fundamental legal framework for working in a coastal and offshore environment.

As water rights become increasingly defined by boundaries, both in international law and domestically, it is essential that those working with spatial information have a legal framework with which to work. Such a framework should make it easier to increase knowledge and awareness of the ways in which developing and established laws affect the spatial work in the coastal and marine environment.

The necessity for such a framework is more compelling when we consider the extent to which surveyors, as well as other professionals working with spatial information, are influenced by the law. In its very first sentence, *Survey Law in Canada*

mentions that "[t]he surveying profession is one which, more than most other professions, comes into frequent contact with the law…." [Campbell, 1989, P. 1]. This is true in the case of water boundaries as much as land boundaries. However, the legal scheme of both property rights and boundary delimitation can be more complicated in the coastal and ocean environment than it is on land.

1.1 The Development of Marine Boundary Law

The theory of land boundaries arose relatively late, largely around the last quarter of the nineteenth century [Johnston, 1988, P. xi]. Many of the early land boundary theorists were "…more or less consciously [motivated] by considerations of national or imperial interest and often used theory to justify conquest for territorial aggrandizement." [Johnston, 1988, P. xii]. Ocean boundary-making, however, has not had the luxury of developing gradually, or with a single driving purpose. Rather, the "…theory of ocean boundary-making has arrived suddenly, as a matter of necessity, at the beginning of a period when the foundations of equitable and efficient ocean development and management must be laid." [Johnston, 1988, P. xii].

Marine boundary theory is still developing, and new considerations come to the forefront all the time due to (1) the variety of boundary types in the ocean, (2) the variety of property rights in the marine environment, and (3) current legal complexities offshore as well as new trends and developments in coastal and offshore law and policy.

---

[1] People working with spatial information in a coastal or offshore environment would include, for example, surveyors, coastal zone managers, hydrographers, and lawyers, etc. Throughout this paper, the term "surveyor" may be used as being representative of these and other relevant professions.

These factors taken together can raise new issues almost daily for the surveyor in the coastal and offshore environment.

1.2 Definitions

1.2.1 Marine Boundaries

For the purposes of this research, the term "marine boundaries" will include all boundaries in the coastal zone and coastal and oceanic waters, as well as those in freshwater areas where applicable. For simplicity's sake, the term will not be limited to national or privately held property boundaries, but will include every kind of boundary in coastal and ocean waters. Occasionally, land boundaries will also be considered where they may have an effect on a marine area, or where they should be included in a multipurpose marine cadastre given a particular legal scheme.

1.2.2 Surveyor

This thesis adopts the definition of a surveyor used by the Fédération Internationale des Géomètres (International Federation of Surveyors), hereinafter referred to as FIG. This definition is as follows, as found on the FIG web site [http://www.ddl.org/figtree/general/definition.htm, 2003]:

> A surveyor is a professional person with the academic qualifications and technical expertise to practise the science of measurement; to assemble and assess land and geographic related information; to use that information for the purpose of planning and implementing the efficient administration of the land, the sea and structures thereon; and to instigate the advancement and development of such practices.

Practice of the surveyor's profession may involve one or more of the following activities which may occur either on, above or below the surface of the land or the sea and may be carried out in association with other professionals.

1. The determination of the size and shape of the earth and the measurement of all data needed to define the size, position, shape and contour of any part of the earth.
2. The positioning of objects in space and the positioning and monitoring of physical features, structures and engineering works on, above or below the surface of the earth.
3. The determination of the position of the boundaries of public or private land, including national and international boundaries, and the registration of those lands with the appropriate authorities.
4. The design, establishment and administration of land and geographic information systems and the collection, storage, analysis and management of data within those systems.
5. The study of the natural and social environment, the measurement of land and marine resources and the use of the data in the planning of development in urban, rural and regional areas.
6. The planning, development and redevelopment of property, whether urban or rural and whether land or buildings.
7. The assessment of value and the management of property, whether urban or rural and whether land or buildings.
8. The planning, measurement and management of construction works, including the estimation of costs.
9. The production of plans, maps, files, charts and reports.

In the application of the foregoing activities surveyors take into account the relevant legal, economic, environmental and social aspects affecting each project.

1.2.3 Spatial Information Management

Spatial information management is defined, for the purposes of this thesis, as the making and implementing of decisions with respect to how spatial information is collected, stored, retrieved, disseminated, and used, based on a well-defined set of objectives.

1.2.4 Technological and Methodological Use

For the purposes of this thesis, the term "Technological and Methodological Use" may encompass the use of any number or variety of technologies; machinery; equipment; or surveying or other methods; including but not limited to data collection, use and dissemination or display methods.

1.2.5 Administration of Property Interests

Land administration provides the mechanisms for allocating and enforcing rights and restrictions concerning land. Land administration usually involves the establishment of a system that is responsible for among other things, boundary delimitation and spatial organisation. [N'gan'ga et al., 2002] As this thesis does not only address land property, but also all types of property rights in marine space, for these purposes, the term administration includes the management and governance of property interests, which may be more specifically defined as property rights, restrictions, and responsibilities. For further clarification of the term Governance:

> Governance is about decision-making and steering, and the distribution of knowledge and power within an organized entity (e.g. a jurisdiction, government department etc.) as that entity pursues its goals and objectives [Centre on Governance, 2000; Paquet, 1994; Paquet, 1997; Rosell, 1999]. Accurate, up-to-date, complete and useful information regarding the resources that currently exist, the nature of the environment within which those resources exist, as well as users' relationships to those resources is therefore always a requirement for effective governance of marine areas. Information on (but not limited to) living and non-living resources, marine contaminants, water quality, shoreline changes, seabed characteristics, bathymetry, spatial extents, and property rights, responsibilities and restrictions all contribute to the

sustainable development and good governance of marine environments [Nichols, Monahan and Sutherland, 2000].

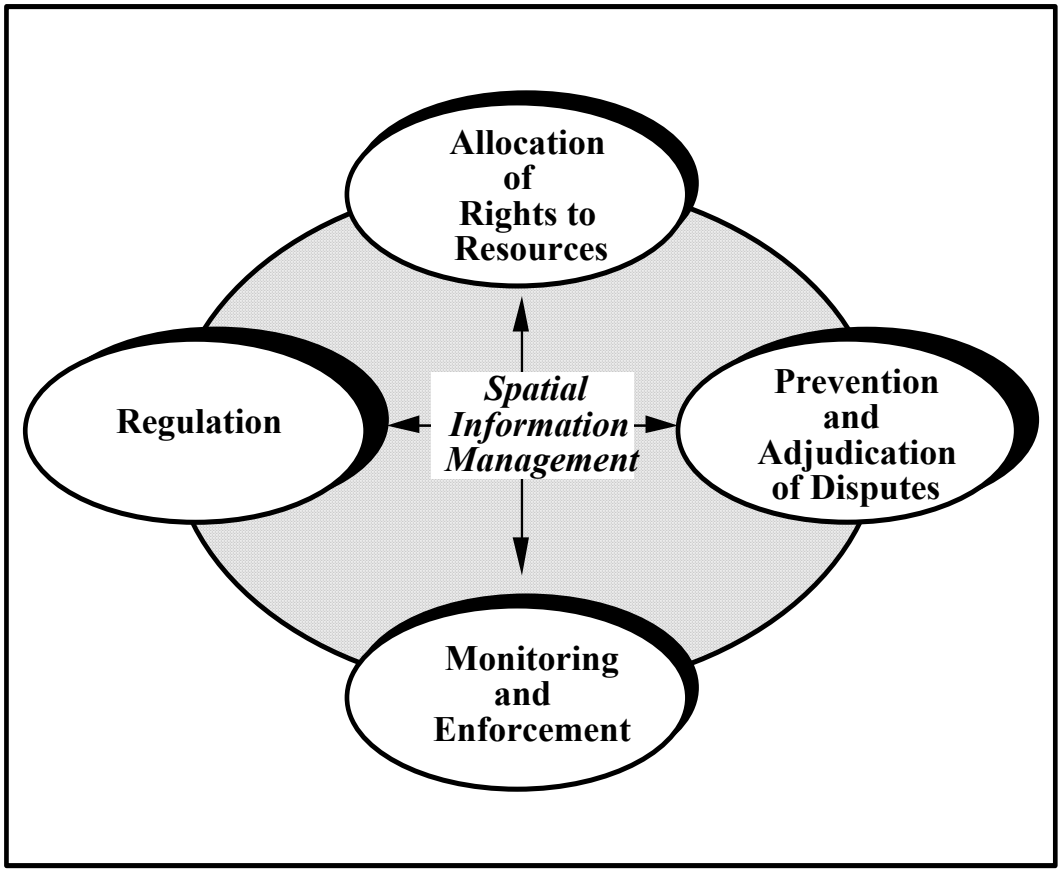


Figure 1.1: Ocean Governance from a Property Rights Perspective [from Nichols, et. al, 2000]

1.3 Emerging Marine Boundary Problems

1.3.1 New Law

There are several major problems facing those who have to work with marine boundaries on a daily basis. First, new law and policies on the subject are emerging all the time, and they take several forms, including international conventions, national legislation, regional and local legislation, case law, arbitration decisions, and environmental, land use, and coastal policies. This is due to an ongoing attempt to cope legally with a new and emerging set of problems. As previously mentioned, the "…theory of ocean boundary-making has arrived suddenly, as a matter of necessity, at the beginning of a period when the foundations of equitable and efficient ocean development and management must be laid." [Johnston, 1988, P. xii]. That is to say, the development of marine boundary law is a necessity because more individuals, groups, business entities and political entities are seeking to use marine resources. This taxes not only the resources themselves, but also the law's ability to deal with conflict if boundaries are not sufficiently defined. Because of the new pressures on marine resources, we can expect entire new areas of law to emerge in an attempt to cope with them.

1.3.2 Diversity of Boundary Types

Second, there are a wide variety of boundary types in the ocean, due mainly to the variety of property rights in the marine environment. These are not always tied to a parcel, and are generally separately held in unbundled form, unlike the traditional Western and Common Law "bundle of sticks" view of land tenure.

1.3.3 Insufficient Boundary Definition

Third, and perhaps most importantly, there are many areas of the marine environment where political, private, group and corporate boundaries or zones are insufficiently defined from a legal perspective and would have to be newly defined should a conflict arise. This is the case for a variety of reasons. Sometimes no conflict has arisen over a particular area or resource, so the courts or the responsible level of government have not been called upon to define a boundary dividing it. Sometimes a particular nation has not yet completed the steps required to define a boundary under international law. Sometimes, although the parties involved would like to define a boundary amicably, they do not have the jurisdiction required to do so without engaging in a legal or political process. Parties may choose not to define a boundary for political reasons, or because they feel that by defining a boundary they are limiting, rather than assuring, their access to resources. There may also be as yet unidentified rights or resources in a given marine area which would require further identification and definition before they could be given bounds. Insufficient boundary definition may

result in, for example, uncertainty in tenure or an inability to resolve disputes efficiently.

1.4 Research Objectives and Methodology

This thesis is the result of case studies of marine law that were completed over approximately the last three-and-a-half years. In order to address the problems outlined in section 1.3, the thesis objectives are:

(1) to examine case studies from major sources of law including international convention, regional legislation, and arbitration panel decisions in order to test the hypothetical common threads affecting the work of the surveyor.

(2) to develop a fundamental legal framework that may be used by surveyors working in coastal and offshore environments to identify the essential ways in which law and policy affect their work.

This thesis began when it became apparent that further work needed to be done on a legal framework for a marine cadastre in order to make such a cadastre comprehensive, multipurpose, and useful to a wide variety of people. During the course of that work, four major questions needed to be asked in order to begin to build a legal framework for such a potentially complex system. These questions were: First, what types of rights exist in a marine context? Second, what types of laws define these rights? Third, can we put these rights in a hierarchy of precedence, and fourth, how can we think about or visualize these rights interacting with one another? The answers to these questions demonstrated that there were three major ways in which the law and

policy surrounding a marine cadastre in this instance could potentially affect surveyors' work, and the work of others working with spatial information in coastal and offshore environments. They were: the management and governance of property rights, restrictions, and responsibilities; the use of established and emergent technologies and methodologies; and the management of spatial information. The scope and breadth of this project, in terms of its newness, and the fact that many of these questions had not been completely or solidly addressed, led to the following questions:

(1) Does the law affect the surveyor and others working with marine spatial information similarly in a variety of boundary situations?

(2) Does the law affect the surveyor and others working with marine spatial information similarly when it comes from different sources, i.e.: do international conventions affect the surveyor similarly to the ways local boundary arbitrations or regional legislation do?

(3) Can a legal framework be built which addresses the major ways in which marine policy and law affect the surveyor and others working with marine spatial information?

This led to the examination of several case studies to attempt to answer these questions. First, a framework of likely legal effects on the surveying community was developed from the marine cadastre case study. The other case studies were then examined to determine not only whether or not they fit inside this model, but also whether they could be used to change or develop it further. In this manner, the case studies involved were tested against the hypothesis in an iterative approach to determine

whether the framework held or whether it needed to be changed to accommodate new considerations.

1.5 Research Contributions and Thesis Organization

1.5.1 Research Contributions

This thesis provides several research contributions, including an examination of the law as it may affect the establishment of a multipurpose marine cadastre. Of course, its main goal is to construct a legal framework that is of use to surveyors and others working with spatial information in marine environments. As ocean boundary law is relatively new in the vast subject of "the law," and because marine boundary law is still evolving and changing, it is impossible to contemplate every legal permutation that may affect the surveyor in the marine environment. However, this thesis does establish a useful framework to serve as a touchstone to those working with spatial data in the marine environment and within which the law may be read to assess the ways in which it will affect them.

Other contributions include the analysis of four situations that involve a variety coastal and offshore rights, interests, claims and spatial limits; this analysis is unique in that the case studies have been conducted to highlight the spatial complexity within a legal context, and that the framework design was tested as to the ways in which rights, interests, etc. can be viewed in a variety of contexts to build the information and administration systems needed to support good ocean governance. The legal framework for a marine cadastre and its components, including the framework's definition of

Boundary Laws, Rights Laws, and Formulaic laws which are new in the field; and the assessment that Boundary Laws, Rights Laws, and Formulaic laws may all play a role in the establishment of a Marine Cadastre; are other contributions.

1.5.2 Thesis Organization

This thesis begins with a first case study – an evaluation of the effects of the law on a marine cadastre – to establish a hypothetical legal framework. It then progresses through four additional case studies in the following order:

1. The United Nations' Convention on the Law of the Sea (UNCLOS) and the Outer Limit of the Continental Shelf;
2. The Newfoundland and Labrador – Nova Scotia Boundary Arbitration; and
3. New Brunswick's Coastal Areas Protection Policy
4. It concludes with a fourth case study – a revisitation of UNCLOS and its specific effects on a marine cadastre called "UNCLOS' Potential Influence on a Marine Cadastre: Depth, Breadth, and Sovereign Rights," – followed by overall conclusions.

CHAPTER 1 REFERENCES

Campbell, B. (1989). "The Canadian Legal System." Chapter 1 in *Survey Law in Canada*, Canadian Institute of Surveying and Mapping, Carswell, Toronto, pp. 1-25.

Johnston, D. M. (1988). *The Theory and History of Ocean Boundary-Making*. McGill-Queens University Press, Kingston and Montreal.

Fédération Internationale des Géomètres (date unknown). *FIG Definition of Surveyor*. Retrieved from the World Wide Web on January 9, 2003.

Ng'ang'a, S., M. Sutherland, S. Cockburn, and S. Nichols (2002). "Toward a 3D Marine Cadastre in Support of Good Ocean Governance: A Review of the Technical Framework Requirements." Accepted for publication in *Computers, Environment and Urban Systems (CEUS)*, 2002.

Nichols, S., D. Monahan and M. D. Sutherland (2000a). "Good Governance of Canada's Offshore and Coastal Zone: Towards and understanding of the Maritime Boundary Issues." In *Geomatica*, Vol. 54, No. 4, pp. 415-424.

2: EFFECTS OF THE LAW ON THE MARINE CADASTRE: TITLE, ADMINISTRATION, JURISDICTION, AND CANADA'S OUTER LIMIT

The development of the legal framework hypothesis arose during the first case study – research on the possible development of a marine cadastre. In the context of information requirements for a marine cadastre, the law arose not only as (1) a basis for many of the boundaries to be found in such a system, but also as (2) the defining force behind many of the private, public, and government interests in a potential marine cadastre, and (3), as a result, one dictator of what boundaries and interests should be included in a multipurpose marine cadastre.

2.1 The Cadastral Concept in the Marine Environment

A cadastre may be defined as a "…record of interests in land encompassing both the nature and extent of these interests." [McLaughlin, 1975]. The multipurpose cadastre concept has been traditionally designed on a three dimensional spatial unit representing unique, homogeneous, contiguous interests [see McLaughlin, 1975; NRC, 1980; Moyer and Fisher, 1973]. In some senses the cadastre also represented a fourth dimension, time (e.g., time-shared interests) [e.g.: Ng'ang'a et al., 2001]. In the marine context, we cannot only consider the interests in the land underlying the water, but must also include interests which can be found at the water's surface, those in the water column and those in the subsurface of the sea floor.

> In the oceans where resources and activities, and therefore rights and restrictions, can co-exist in time and space and can move over time and

space, the definition of a parcel is… complex. Until another framework is proven more useful, the cadastral concept may help the initial exploration of ideas. [Ng'ang'a et al., 2001].

2.2 The Law, Property Interests, and the Marine Cadastre: An Argument for 3D Visualization

Extracted from:

Ng'ang'a, S., M. Sutherland, S. Cockburn and S. Nichols (2001). "Toward a 3D Marine Cadastre in Support of Good Ocean Governance." Presented at *Registration of Properties in Strata*, International Workshop on 3D Cadastres, Delft, Netherlands, 28-30 November 2001.

The extracted sections were written by the author of this thesis.

2.2.1 Land-based vs. Water-based Property Interests

For many years, the Common Law has regarded property rights as a "bundle of sticks" which consists of many strands, each representing a separate right in the property. [Kaiser Aetna v. U.S., 444 U.S. 164, 176 (1979); Black, 1990]. Traditionally, many of the strands or elements of the bundle have been held by a single person or legal entity at any given time. Today complicated zoning regulations, easements, leases, and other use rights complicate the traditional system. Some authors [see Hoogsteden and Robertson, 1998, 1999] have advocated the "unbundling" of these property rights in order to clarify today's complicated ownership scheme. Cadastre 2014 (3.2) promotes the division of rights into "legal land objects" as follows: "If a law defines phenomena, rights, or restrictions which are related to a fixed area or point of the surface of the earth, it defines a land object" [Bevin, 1999].

….. defining a land object based on the surface area of land it occupies does not present an accurate view of every right that may exist in that land. Clearly, the right to explore for minerals may have an impact on the surface of the land, but it will also affect a 3D cross-section of the parcel below the land's surface. 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.

Nowhere is the need to unbundle rights in 3D form more pressing than in the world's oceans. This is true for several reasons. First, in a marine environment, individual ownership of a "parcel" is not the norm. Government ownership, public rights, and international law may usurp what private rights do exist in the water column, and may eliminate an individual's "right to exclude others from the property," which is traditionally considered one of the most treasured strands in a property owner's bundle of rights. [Kaiser Aetna v. U.S., 444 U.S. 164, 176 (1979); Loretto v. Teleprompter Manhattan CATV Corp. et al, 458 U.S. 419 (1982)]. This absence of the parcel in a marine setting, and the lack of an individual owner holding many simultaneous rights, makes a bundled portrayal of rights in a marine cadastre ineffective when it comes to decision-making. The distinct portrayal of these rights is essential for informed policy-making.

Secondly, few marine activities can be said to take place on the "surface" of the water. Nearly everything marine actually takes place in a volume of water. Most marine rights, such as aquaculture, mining, fishing, and mooring rights and even navigation have an inherently three-dimensional nature, which makes a two-dimensional definition of these rights legally inadequate. Where and how do these rights overlap? It is entirely possible that any two marine rights intersect not at the surface of the water, but at some point far below, in the water column or even within the seabed. In order to control and regulate marine activity, a more accurate portrayal of rights in the water column is required. This can only be achieved using a three-dimensional representation of these rights.

End of Extract

2.3 The Basics of a Legal Framework for a Marine Cadastre

Extracted from:

Cockburn, S. and S. Nichols (2002). "Effects of the Law on the Marine Cadastre: Title, Administration, Jurisdiction, and Canada's Outer Limit." In *Proceedings of the XXII FIG International Congress, 2002.* Presented at the XXII FIG International Congress, Washington DC, USA, April 24, 2002.
http://www.fig.net/figtree/pub/fig_2002/Js12/JS12_cockburn_nichols.pdf

The extracted sections were largely written by the author of this thesis, with editing by Dr. Nichols.

When considering the legal framework for the marine cadastre, four things must be taken into account. First, what types of interests and boundaries exist in a marine context? Second, what types of laws define these rights? Third, can we put these rights in a hierarchy of precedence, and fourth, how can we think about or visualize these rights interacting with one another?

2.3.1 Rights and Boundary Types in a Marine Cadastre

The first consideration, i.e., which types of rights exist in a marine cadastre, is, in some ways, the easiest to answer. Title searches and a broad-based study of laws which may effect a marine "parcel," including such things as fisheries and aquaculture, navigation, environmental laws, criminal laws, oil and gas interests, First Nations' interests, etc., usually lead to the discovery of most interests in the marine context. Consideration of other typical rights might include cable laying and flood control, as well as public rights of access. In most jurisdictions, however, marine rights are myriad and are superimposed in such a way that it is extremely difficult to disentangle them.

One approach is to try to associate each right with a particular stake-holder. For example, private persons may have rights of access to the water as well as rights of fishing, rights to clean water, rights to flood control, or they may hold a private lease to a water lot or aquaculture site.[2] Companies and private entities may hold certain oil and gas or mineral rights, fishing licenses, or cable laying privileges. They may also have leaseholds or other rights in aquaculture or water lots, although these are often on a larger scale than rights held by a private person. First Nations may have rights to a marine area, or certain resources of an area, based on tradition and treaties. Public rights may include, for example, rights of access to the foreshore, rights of fishing, and rights of navigation. However complicated the private and public rights in a given area may seem, most marine rights have one thing in common: they exist because they were implemented by law.[3]

The complexity of rights in marine space, however, is not to be underestimated….ocean boundary-making is relatively new, and is largely undertaken in response to new demands on ocean and marine

[2] This list is not meant to be exhaustive.
[3] One arguable exception to this general rule is First Nations' rights, which pre-date much modern law, despite their current form being codified in treaties as well as statute.

spaces. To give a more detailed example of some of these demands, Douglas Johnston [1988], names the following zoning practices in the marine environment: mariculture; mineral extraction; ports; fishing; military security; fiscal and customs control; public health; immigration; environmental protection; vessel traffic control; fishery development, management, and conservation; offshore mineral production; and coastal zone management and sea use planning.

This list includes traditional zoning practices, administrative control zone practices, and resource development, management and conservation zones. Other broad types of boundaries Johnston [1988] mentions are lateral boundaries, baselines, closing lines, and seaward limits. These, of course, do not include the boundaries of privately held rights within a particular zone, First Nations and group interests, general public rights of access and navigation, and the application of criminal law within a particular area, to name a few.

2.3.2 Government Interests and Types of Law in a Marine Cadastre

2.3.2.1 Government interests

Black's Law Dictionary defines law as "…a body of rules of action or conduct prescribed by controlling authority, and having binding legal force."[4] Laws may also, particularly in Common Law jurisdictions, arise through tradition and long use. These are typically incorporated into statute or the Common Law through court decisions. Either way, laws and regulations create or describe rights, and then give the means to implement or enforce them. In the case of the marine cadastre, a government may maintain legislative jurisdiction, which can be defined as "[t]he sphere of authority of a legislative body to enact laws and to conduct all business incidental to its law-making function,"[5] as well as the right to administer the law. Administrative authority is defined by Black's Law Dictionary as "The power of an agency or its head to carry out the terms of the law creating the agency as well as to make regulations for the conduct of business before the agency;

[4] Black, H.C. (1979). *Black's Law Dictionary, 5th Edition*. (5th Edition by The Publisher's Editorial Staff – Contributing authors J. R. Nolan and M.J. Connolly), West Publishing Company, St. Paul Minnesota. P. 795.
[5] Ibid., P. 810.

distinguishable from legislative authority to make laws."[6] Of course, governments may also hold title to the seabed and subsurface, as well as the water column above them.

These government rights can, in some senses, be thought of as the controlling force over all private and public rights in a nation's waters. Most nations have a series of checks and balances so that the government does not overstep its authority, but these are jurisdiction-dependent. The goal here is to draw a broad legal framework within which most rights in the marine cadastre may fit.

The rights so far described in the marine cadastre may be broadly drawn as shown in Figure 2.1:

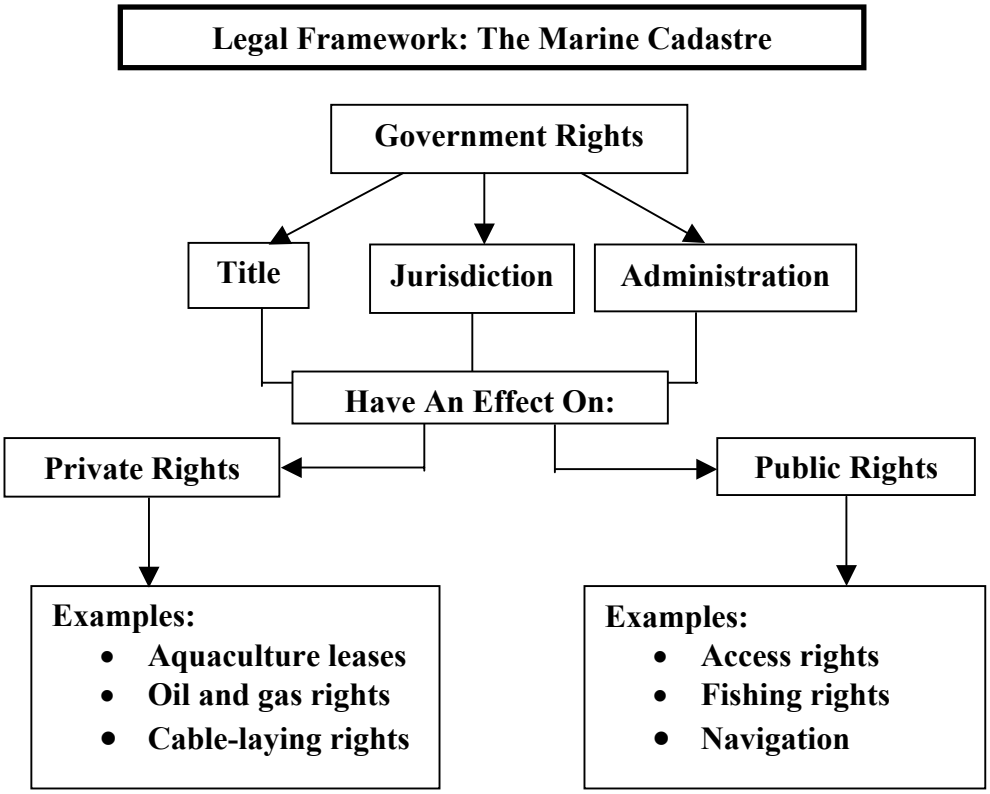
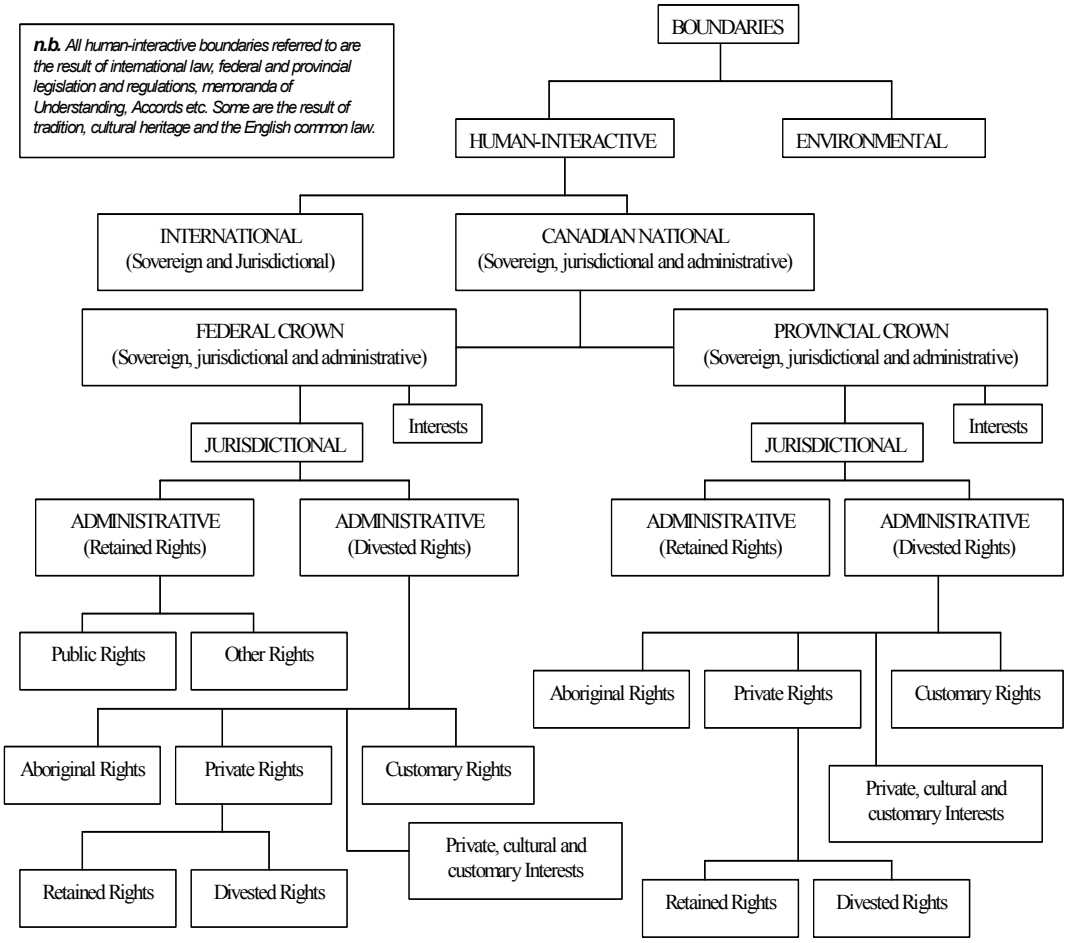


Figure 2.1: How government rights affect the marine cadastre.

Naturally, this basic framework can be greatly expanded depending on the jurisdiction. Canada's framework for organizing just human-

[6] Ibid., P. 42.

interactive types of boundaries, for example, and this does not include any specific government, private or public rights, might resemble a complicated diagram such as Figure 2.2:



From Sutherland, 2002

Figure 2.2: Canada's framework for organizing human-interactive types of boundaries.

Figure 2.2 is further complicated by the consideration that the provincial government, or an agency thereof, may, under specific circumstances, administer a federal law or regulation. Similarly, a regional or local government might administer some provincial laws and regulations. Also, as previously mentioned, while this schematic seems expansive, it does not include any individual, private or specific public rights. However, it does evaluate broad classes of rights, and gives a

fundamental breakdown of the types of government rights to be found in Common Law federations.

2.3.2.1 Types of Law

Apart from defining the broad ways in which a government may rule the marine cadastre, it may be indispensible to examine *in what way* specific laws ("law" here is broadly defined to include both statute and legal truths developed via *stare decisis* in Common Law jurisdictions) have direct bearing on the marine cadastre. Three broad types of laws may be found as follows:
(1) Boundary laws: these typically define a particular boundary in order to enclose a right within it. For example, these may include zoning laws, including fishing zones, or property boundary regulations.
(2) Rights laws: these usually affirm a right without defining a *particular* boundary. First Nations' rights, and rights of access and navigation are examples of these "laws," and may in theory extend as far as the nation's waters may extend.
(3) Formulaic laws: these describe a formula for finding a boundary within which certain rights will exist, without defining the boundary in specific terms such as coordinates. The result is that there is work left to be done in order to delimit the boundary, which may lead to some uncertainty in terms of the marine cadastre The consummate example of this type of law is the *United Nations Convention on the Law of the Sea* (*UNCLOS*)[7], which contains sometimes complex formulas for finding boundaries, the most complicated of which is the formula for finding the limit of a nation's extended Continental Shelf. If a nation has a physical continental shelf beyond 200 nautical miles, as Canada does, it then must follow a complex series of guidelines to find its outer limit, and hence the potential outer limit of its marine cadastre.

2.3.3 Hierarchy of Laws and Rights

The next thing to consider about the legal framework of the marine cadastre is whether we can place these laws in some kind of hierarchy. That is, can we develop a framework in which we know which rights take precedence over other rights? This exercise is necessarily

[7] 1982 LOS Convention opened for signature 10 December 1982, UN Doc. A/Conf. 62/122 reprinted in United Nations, Official Text of the United Nations Convention on the Law of the Sea with Annexes and Index (New York: UN Sales No. E83.V.5, 1983).

jurisdiction dependent, as the number of levels of government and their legal hierarchies vary by jurisdiction. In the U.S. and Canada, the general configuration is that Constitutional law is paramount, and that governments must abide by a constitutional division of powers. The federal government, operating within its rights, is the next authority, and provincial or state laws that are of concurrent jurisdiction must usually not contradict it. Provincial and state laws are the next authority, followed by county and municipal laws, depending on the jurisdiction.[8]

Some rights, such as the paramount public right to navigation, also take precedence over other rights, and "…whenever it conflicts with the rights of the owner of the bed or of a riparian owner it will prevail."[9] "Nothing short of legislation can take away the public right of navigation… [a]ccordingly a Crown grant of land does not and cannot give a right to interfere with navigation."[10] This right would, therefore, take precedence over other rights granted in marine areas unless specifically abolished or made less paramount by statute.

……

…

2.3.4 The Marine Cadastre Legal Framework: Conclusions

Arriving at an accurate legal framework for the marine cadastre requires four procedures. First, the wide variety of rights that may exist in the marine context should be identified. It is important to keep in mind that these rights may change depending on the jurisdiction, as well as on whether the waters involved are tidal or non-tidal, or navigable or non-navigable and how far the right extends from shore. For example, under UNCLOS, the seabed and subsurface remain under a nation's jurisdiction for certain purposes only on the Extended Continental Shelf, but the nation does not retain rights to the water column at that distance from its baselines. Also, room should be left in case previously unidentified rights arise or are discovered at a later date.

Second, the various laws that identify these rights, as well as the ways in which these laws have direct impact on the marine cadastre

[8] To undertake a full description of Canadian or U.S. constitutional law with examples is beyond the scope of this thesis, but this very basic layout indicates that it is usually possible to arrive at such a hierarchy.

[9] LaForest, G.V. and Associates, *Water Law in Canada: The Atlantic Provinces*. Regional Economic Expansion, Information Canada, Ottawa, 1973. P. 185

[10] LaForest, G.V. and Associates, *Water Law in Canada: The Atlantic Provinces*. Regional Economic Expansion, Information Canada, Ottawa, 1973. P. 190

should be considered. "Boundary laws," "rights laws," and "formulaic laws" each influence the marine cadastre in different ways. It is important to consider how to incorporate specifically delineated boundaries and rights, as well as those that are to be arrived at by formulas, into a marine cadastre. Naturally, the engineering and science communities may not have completed formulaic boundaries by the time a marine cadastre is called for.

Third, it will be important from a legal perspective for private individuals and governments alike to have a recording of which rights and laws take precedence over other rights and laws in the hierarchy. This may help to avoid unnecessary conflict and confusion when examining the marine cadastre in its entirety. Fourth and lastly, jurisdictions should consider how to visualize rights and boundaries in a marine cadastre so that they are clear, and so that the places where they overlap are evident. This will add additional clarity in case of conflict, as many rights in a marine cadastre may overlap in three dimensions below the water's surface in the water column or below the seabed.

End of Extract

2.4 The Marine Cadastre Case Study: Development of a Hypothesis

The answers to the questions surrounding the marine cadastre legal framework led to other questions. The most broad of these questions was: "How does this legal framework affect those working with spatial information in the marine environment?" While it was obvious that there would be plenty of detailed work involved in filling out the specific legal framework for a marine cadastre, such as looking up specific laws, this question was more broad-based. *Specifically, could a legal framework be developed using the marine cadastre example that would continue to affect the surveyor or others working with spatial information in a marine environment on a daily basis?* Could this framework then be applied to other surveying work in a marine environment?

2.4.1 Developing a Tripartite Argument

The marine cadastre example demonstrated that there were three major ways in which the law and policy surrounding a marine cadastre in this instance could potentially affect spatial work win a marine environment. They were:

(1) The administration, governance and management of property rights, restrictions, and responsibilities; that is to say, the administration of property interests. First, development of a 3D marine cadastre could potentially lead to better descriptions of legal property interests and a better understanding of jurisdictional problems, which could lead to better decision-making and could serve as better evidence than what is currently available. This, in turn, could make dispute resolution more efficient. Second, the jurisdictional clarity a 3D marine cadastre might invoke would give a better sense of what government body is in charge of a particular resource, making the task of finding necessary information about that resource faster and more efficient. Third, the question of who should be in charge of the initial collection of this boundary evidence, evidence of historical rights,[11] and evidence of conflict between the rights needs to be answered. While survey responsibilities are divided by statute between Canada Lands Surveyors and provincial surveyors, questions may arise where ownership of waters is disputed [Nichols, S. et al., 2001]. All of the policy and law that would need to be developed to answer these administration questions will have some bearing on a surveyor's work in a marine environment.

[11] Locally, one example of such evidence might be the submerged or partially submerged poles of old weirs.

(2) The use of established and emergent technologies and methodologies. First, as described above, at least a three-dimensional, and more likely a four-dimensional visualization tool may be required in order to convey a legally adequate description and delimitation of property rights. Second, seamless database problems may occur. Differing chart and land data types and standards would cause problems for the surveyor. Also, the establishment of a common datum and a common coordinate system among all the boundaries that would have to be incorporated in a marine cadastre would be a major undertaking. Third, surveyors would have to technologically incorporate the overlapping hierarchies of rights established by the law. Fourth, monumentation issues may arise, especially given the marine environment.

(3) The management of spatial information. Forcing data to be integrated into one system should eventually make data integration of all these coastal and marine data sets more viable for widespread use and data sharing. This would, no doubt, raise issues, such as who will pay for the collection of the information and how. It may also raise concerns in the realm of access versus privacy.

The establishment of common data and metadata standards for marine cadastre data would also fall into the information management category. Furthermore, the question of where the data would be housed, as well as questions of data custodianship, ownership, and responsibility for data updates and maintenance would arise.

Under the marine cadastre case study, then, there are three major categories of ways in which the law may influence work with spatial information in the marine environment. These may be illustrated as in Figure 2.3:

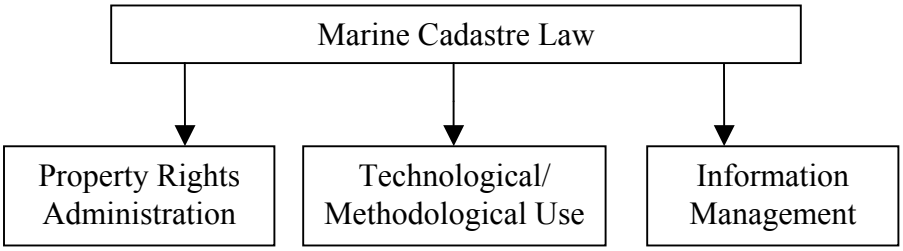


Figure 2.3: Marine Cadastre law could affect these areas.

2.4.2 The Hypothesis

These conclusions led to the following hypothesized legal framework (see Figure 2.4):

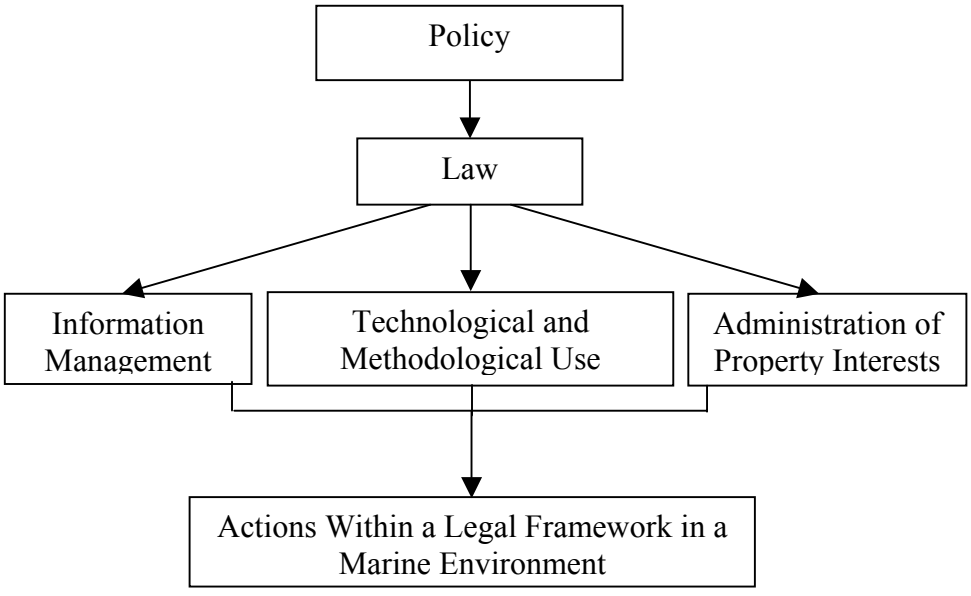


Figure 2.4: The hypothesized Legal Framework for spatial work in a marine environment.

2.5 Issues With This Case Study

There are several issues with this case study. First, there is no body of law that establishes a multipurpose marine cadastre and dictates data inclusion as well as technological standards[12]. Because the marine cadastre concept is in its infancy, there is no accepted norm for marine cadastre policy. While there are established working groups around the world,[13] the idea of what data should be included in a marine cadastre is still open to debate, and the data collection and management issues have not been widely addressed. Futhermore, the lack of a statutory framework has not been mitigated by case law or convention. In short, without legal decisions or a statutory framework to evaluate, the hypothetical ways in which such a legal framework might affect the surveyor are largely the product of brand new research.

2.6 How to Test the Hypothesis

This thesis' hypothesis is that marine and water boundary laws affect surveyors in three principal ways: they affect the management and governance of property rights, restrictions, and responsibilities; the use of established and emergent technologies and methodologies; and the management of spatial information. There are two main ways to test this hypothesis. The first way to test it is to evaluate marine and water boundary laws for different types of marine boundary to see whether they have an effect on the

[12] The United States has a marine cadastre, but it is not currently multipurpose as that term is understood by this paper (i.e. it may have several purposes, but, for instance, does not currently represent the wide variety of private and public rights discussed in later chapters – it seems to be currently mainly used for the purpose of administering mineral rights offshore, although the Marine Boundary Working Group seems to have broader longer-term goals). http://www.csc.noaa.gov/mbwg/htm/cadastre.htm

same three areas. For example, does the law surrounding a single type of marine boundary affect surveyors in the same ways the law surrounding an entire marine cadastre would?

The second way to test the hypothesis is to see if it holds true in differing legal settings. In other words, does the law affect the surveyor similarly when it comes from different sources, i.e.: do international conventions, regional boundary arbitrations, or regional legislation affect the surveyor in the same three areas?

[13] See, for example, the U.S. Marine Cadastre home page at http://www.csc.noaa.gov/mbwg/htm/cadastre.htm

CHAPTER 2 REFERENCES

1982 LOS Convention opened for signature 10 December 1982, UN Doc. A/Conf. 62/122 reprinted in United Nations, Official Text of the United Nations Convention on the Law of the Sea with Annexes and Index (New York: UN Sales No. E83.V.5, 1983).

Bevin, T. (1999). Cadastre 2014 Reforms in New Zealand. In *the Coastal Cadastre: Onland, Offshore. Proceedings from the New Zealand Institute of Surveyors & FIG Commission VII Conference*, Waitangi, New Zealand.

Black, H.C. (1979). *Black's Law Dictionary, 5th Edition*. (5th Edition by The Publisher's Editorial Staff – Contributing authors J. R. Nolan and M.J. Connolly), West Publishing Company, St. Paul Minnesota.

Borissova, I., P.A. Symonds, R. Gallagher, B.C. Cotton and G. Hill (1999). "A Set of Integrated Tools based on Arcview for Defining the Outer Limit of Australia's Extended Continental Shelf". In Proceedings of the International Conference on Technical Aspects of Maritime Boundary Delineation and Delimitation, International Hydrographic Bureau, Monaco, September 8-9.

British Oceanographic Data Centre-BODC (2001). The GEBCO Digital Data Atlas. http://www.bodc.ac.uk/frames/index2.html?../projects/gebco/index.html&2, accessed, September 2001.

Centre on Governance (2000). "What is governance?" Centre on Governance, University of Ottawa. http://www.governance.uottawa.ca/english/overview/o_definition, accessed November 2000.

Cockburn, S. and S. Nichols (2002). "Effects of the Law on the Marine Cadastre: Title, Administration, Jurisdiction, and Canada's Outer Limit." In *Proceedings of the XXII FIG International Congress, 2002.* Presented at the XXII FIG International Congress, Washington DC, USA, April 24, 2002. http://www.fig.net/figtree/pub/fig_2002/Js12/JS12_cockburn_nichols.pdf

Eckert, R. D. (1979). *The Enclosure of Ocean Resources: Economics and the Law of the Sea.* Hoover Institution Press, Stanford University, Stanford, California.

Elema, I. and K., de Jong (1999). The Law of the Sea in the North Sea. In Proceedings of the International Conference on Technical Aspects of Maritime Boundary Delineation and Delimitation, International Hydrographic Bureau, Monaco, September 8-9.

Gomes, G. (1998). "The review of the NOAA National Coastal Zone Management Programs for Estuary and Coastal Wetland Protection." http://www.oceansconservation.com/iczm/gomes.htm. Accessed September 2000.

Groten, E. (1999). "Coastal Boundaries and Vertical Datums." In Proceedings of the International Conference on Technical Aspects of Maritime Boundary Delineation and Delimitation, International Hydrographic Bureau, Monaco, September 8-9.

Holmes, C.(1999). "The Relevance of MultiBeam Data in the Coastal Cadastre. In the Coastal Cadastre: Onland, Offshore." In *Proceedings from the New Zealand Institute of Surveyors & FIG Commission VII Conference*, Waitangi, New Zealand.

Hoogsteden, C.C., and W.A. Robertson (1998). On Land - Off Shore: Strategic Issues in Building a Seamless Cadastre for New Zealand. XXI International Congress Proceedings: Developing the Profession in a Developing World, International Federation of Surveyors, Commission 7, Cadastre and Land Management, p. 32-48, Brighton.

Hoogsteden, C.C., and W.A. Robertson (1999). Re-engineering New Zealand's Cadastre: Strategic Issues in Building an Onland-Offshore Cadastre. GIM international,Vol. 13, No. 6, p. 7-9, June 1999.

Hoogsteden, C.C., and W.A. Robertson (1999). Re-engineering New Zealand's Cadastre: Strategic Issues in Building an Onland-Offshore Cadastre. GIM International, Vol. 13, No. 6, p. 7-9, June 1999.

Kaiser Aetna v. United States, 444 U.S. 164, 176 (1979). Retrieved on September 14, 2001 from the FindLaw website on the World Wide Web. http://caselaw.lp.findlaw.com/scripts/getcase.pl?navby=case&court=US&vol=444&invol=164.

LaForest, G.V. and Associates, *Water Law in Canada: The Atlantic Provinces*. Regional Economic Expansion, Information Canada, Ottawa, 1973.

Loretto v. Teleprompter Manhattan CATV Corp., 458 U.S. 419 (1982). *Fundamentals of Modern Real Property Law, Third Edition*. Rabin, E.H., and R.R. Kwall. The Foundation Press, Inc., Westbury, New York. 1992.

McLaughlin, J.D. (1975). The Nature, Function and Design Concepts of Multipurpose Cadastres. Unpublished Ph.D. Dissertation in Civil and Environmental Engineering, Madison: University of Wisconsin.

Miles, E. L. (1998). "The concept of ocean governance: Evolution towards the 21st century and the principle of sustainable ocean use." Paper prepared for SEAPOL workshop on ocean governance and system compliance in the Asia-Pacific context. Rayong, Thailand, 1997.

Monahan, D. and S., Nichols (1999). Fuzzy Boundaries in a Sea of Uncertainty: Canada's Offshore Boundaries. In The Coastal Cadastre - Onland, Offshore - Proceedings of the New Zealand Institute of Surveyors Annual Meeting, Bay of Islands, NZ, Oct 9-15, pp. 33-43.

Moyer, D.D. and K.P. Fisher (1973). Land Parcel Identifiers for Information Systems. Chicago: American Bar Association.

National Research Council (1980). Need for a Multipurpose Cadastre. Panel on a Multipurpose Cadastre, National Academy Press, Washington, D.C.

Ng'ang'a, S., M. Sutherland, S. Cockburn and S. Nichols (2001). "Toward a 3D Marine Cadastre in Support of Good Ocean Governance." Presented at *Registration of Properties in Strata*, International Workshop on 3D Cadastres, Delft, Netherlands, 28-30 November 2001.

Nichols, S., D. Monahan and M. D. Sutherland (2000). "Good Governance of Canada's Offshore and Coastal Zone: Towards and understanding of the Maritime Boundary Issues." In *Geomatica*, Vol. 54, No. 4, pp. 415-424.

Nichols, S., I. Edwards, J. Dobbin, K. Komjathy, and S. Hanham (1997). Real Property Issues in the Marine Acquaculture Industry in New Brunswick. Fredericton, NB: Dept. of Fisheries and Aquaculture.

Nichols, S., M. Sutherland, S. Ng'ang'a, and D. Monahan (2001). Report on the proceedings of the Association of Canadian Land Surveyors Stakeholders Workshop on Canada Lands Offshore. Published by the Association of Canada Lands Surveyors.

Paquet, G. (1994). "Reinventing Governance." In *Opinion Canada,* Vol. 2, No. 2, April.

Paquet, G. (1997). "Alternative service delivery: Transforming the practices of governance." In *Alternative Service Delivery: Sharing governance in Canada.* Eds. Ford, R. and D. Zussman, KPMG • The Institute of Public Administration, University of Ottawa Libraries.

Payoyo, P. B. (1994). "Editor's introduction." In *Ocean Governance: Sustainable Development of the Seas*. Ed. Payoyo, United Nations University Press, Tokyo, New York, Paris.

Prescott, J. R. V. (1985). The Maritime Political Boundaries of the World. Methuen, London, New York.

Rosell, S. A. (1999). *Renewing Governance: Governing by learning in the information age.* Oxford University Press.

Sutherland, M. (2002). "A Classification of Canadian Marine Boundaries and the Design of a Conceptual Marine Boundary Database Framework." Contract report prepared for Fisheries and Oceans Canada (Canadian Hydrographic Services). March 2002.

U.S. Marine Cadastre website. Retrieved on April 20, 2001 from the World Wide Web. http://www.csc.noaa.gov/mbwg/htm/cadastre.htm

van de Poll, R., M. Halim, M. D'Arcy, J. Harding, R. Macnab, and D. Monahan (1999). Integrated Procedures for Determining the Outer Limit of the Juridical Continental Shelf Beyond 2000 Nautical Miles. In Proceedings of the International Conference on Technical Aspects of Maritime Boundary Delineation and Delimitation, International Hydrographic Bureau, Monaco, September 8-9, pp 235-246.

Vanicek, P. and E.J. Krakiwsky (1982). *Geodesy: The Concepts*. North Holland Publishing Company, Amsterdam.

Wilkins, K., M. Sutherland, S. Nichols and G. Paquet (2001). Ocean Governance: Geomatics as a Technology of Collaboration. Presented at GEOIDE conference, 2001, Fredericton, NB, Canada, June 21-22.

3: CASE STUDY II: UNCLOS AND THE OUTER LIMIT OF THE EXTENDED CONTINENTAL SHELF

3.1 The Selection of the UNCLOS Case Study

When the United Nations Convention on the Law of the Sea (UNCLOS) was opened for signature in December of 1982, its purpose was to "[establish] a comprehensive regime 'dealing with all matters relating to the law of the sea,… bearing in mind that the problems of ocean space are closely interrelated and need to be considered as a whole." [1982 LOS Convention, xviiii]. UNCLOS is an international legal regime relating to ocean space and having to do with marine boundaries, as well as rights, restrictions and responsibilities in ocean space. This case study meets the testing criteria of section 2.6 because (1) it deals with specific ocean boundaries and establishes specific criteria for defining them and (2) it is an established legal regime in the form of an international convention.

While examining every nuance of the UNCLOS regime is beyond the scope of this project, selecting one portion of it, which deals with one specific boundary, is not. The Continental Shelf regime under UNCLOS is interesting and pertinent for several reasons which will be explained in this chapter, not least of which are the ways in which policy and technology influence one another in this section of the Convention.

3.2 The UNCLOS Case Study

Extracted from:

Cockburn, S., S. Nichols, D. Monahan and T. McDorman (2001). "Intertwined Uncertainties: Policy and Technology on the Juridical Continental Shelf." In *Proceedings of the Advisory Board on the Law of the Sea to the International Hydrographic Organization (ABLOS) Conference "Accuracies and Uncertainties in Maritime Boundaries and Outer Limits."* Presented at the International Hydrographic Bureau, Monaco, October 2001.
http://www.gmat.unsw.edu.au/ablos/COCKBURN.PDF

The author of this thesis completed the first draft of the legal portions of this paper, and worked with Mr. McDorman in revising and editing subsequent drafts of the legal sections. Mr. Monahan authored the technical sections such as the technical uncertainty sections. Dr. Nichols reviewed and edited the final draft.

> It would be a misconstruction to attempt to entirely separate technological uncertainties from legal/political uncertainties in the case of the juridical continental shelf. The truth is that technology is now playing a driving role in the development of continental shelf policy, and as a result is a force and a factor in our ability to justly apportion the juridical continental shelf. Indeed, the technological and legal uncertainties involved in an extended continental shelf claim are inexorably intertwined.
>
> This paper will examine the ways in which technology is driving continental shelf policy and will make use of a specific example (Canada's Orphan Knoll) to demonstrate how legal and technological uncertainties intertwine to form a complex matrix of questions about the methods for preparing an extended continental shelf claim.

1. INTRODUCTION: THE CHANGING FACE OF TECHNOLOGICAL INFLUENCES ON POLICY

> Traditionally, law and policy have been controlling factors in the use and development of technology. Patents and licenses, for example, have long regulated technological progress and applications.[14] This

[14] Patents amount to a "grant of right to exclude others from making, using or selling one's invention and includes [the] right to license others to make, use, or sell it." [Black, 1990, p. 1125 *citing* Valmont Industries, inc. v. Yuma Mfg. Co., D.C. Colo., 296 F. Supp. 1291, 1294.] Licenses are a "written

trend is slowly changing as high-speed technological growth is beginning to set the pace for policy development.[15] This has resulted in cases where either the law and technology influence each other's evolution, or where technological standards are at the heart of policy development.

Both are the case in outer continental shelf concerns. Indeed, it is widely known that one of the catalysts for the inclusion of outer continental shelf issues in the UNCLOS negotiating forum was the existence of technologies capable of extracting non-renewable resources from both the continental margin and the deep seabed. Scientific and technological possibilities heavily influenced the wording of the final product of UNCLOS, the 1982 Law of the Sea Convention,[16] on the definition of the continental shelf and the criteria for the determination of the outer limit of the legal continental shelf – Article 76. The wording of Article 76, a product of political compromise with some of the key issues left deliberately ambiguous, remains an area of inextricably intertwined political, legal and technological uncertainties.

All boundaries and most particularly national boundaries are political and are determined solely by the national government. Only in the rarest of situations does a State yield the decision-making respecting the location of a national boundary to an independent authority. Regarding maritime boundaries, for example, Canada has established unilaterally and without consultation with any other States the outer limit of its 200-n. mile zones even in situations where the claimed areas overlap with claims of other states (for example, in the Beaufort Sea where the Canadian claim overlaps with that of the United States). Canada has agreed on two occasions (in the Gulf of Maine vis-à-vis the United States and in the outer Gulf of St. Lawrence vis-à-vis France) to

---

authority granted by the owner of a patent to another person empowering the latter to make or use the patented article for a limited period or in a limited territory." [Black, 1990, p. 920]. As such, the laws surrounding patents and licenses control technological use, sale and manufacture, and distinguish between "true" (i.e. patentable) inventions, and those that are merely copying a previous invention. This is only one example of the ways in which law controls technology. We have only to look at the laws surrounding cloning and stem cell research to note that other laws may control, for example, the purpose to which technologies are applied.

[15] The most obvious case is the regulation of information dissemination over the Internet. Web development has resulted in new jurisdictional problems [The Economist, 2001], a confused legal setting for the protection of some data (such as spatial data) [Pluijmers and Onsrud, 1997], and new copyright issues due to the new ways of duplicating and using authored works [Hardy, I.T., 1998]. In the case of extended continental shelf claims, the technological ability to map the deep ocean has been incorporated into the Scientific and Technical Guidelines of the Commission on the Limits of the Continental Shelf.

[16] 1982 LOS Convention opened for signature 10 December 1982, UN Doc. A/Conf. 62/122 reprinted in United Nations, Official Text of the United Nations Convention on the Law of the Sea with Annexes and Index (New York: UN Sales No. E83.V.5, 1983).

allow an independent judicial body to determine the location of the maritime boundary between the conflicting offshore claims of the States.

Article 76 of the Law of the Sea Convention allows States to extend their exclusive national jurisdiction over areas of the continental margin beyond 200 M. Article 76 provides a complex series of criteria (not just distance as in the case of the 200 M. zone) that States are to take into account when establishing the outer limit (i.e. boundary) of their continental shelf. A critical feature of Article 76 is that there is a limit on a State's continental shelf claim. This is one of the essential differences between Article 76 and its predecessor Article 1 of the 1958 Geneva Convention on the Continental Shelf. One might be inclined to reflect that it is not overly critical where the Article 76 outer limit is located (assuming the outer limit is not based on an exaggerated claim) provided that it is finalized. Put another way, technical virtuosity respecting the location of the outer limit of the continental shelf may be less important than the political feature of the outer limit being "final and binding".

Part of the political compromise respecting Article 76 is the establishment of the Commission on the Limits of the Continental Shelf which has as its mandate the perusal of State claims made to continental margin areas beyond 200 M. In the context of ocean boundary-making, the Commission is a unique body. According to the government of the United States:

> The Commission is designed to provide a mechanism to prevent or reduce the potential for dispute and uncertainty over the precise limits of the continental shelf where the continental margin extends beyond 200 miles. … *Ultimate responsibility for delimitation lies with the coastal State itself*, subject to safeguards against exaggerated claims. (*Emphasis added*)[17]

The Commission, deliberately composed solely of technical experts to enhance the apolitical function it has been assigned, is to receive information on outer continental shelf claims and make recommendations to the submitting State concerning that information and the Article 76 criteria. It is, therefore, the Commission and the submitting State that will be faced with the intertwined uncertainties of

[17] Treaty Doc. 103-39, 103rd Congress, 2d Session, Senate, Message From the President of the United States, U.S. Government Printing Office, Washington, 1994.

legal wording, politics and technology of Article 76. The nature of that uncertainty can be illustrated using the following questions:

1) Is there a burden of proof a claiming State must fulfill in order to pass the Commission on the Limits of the Continental Shelf's (CLCS) inspection of that State's Article 76 claim?

2) In what ways were the hierarchies of evidence in the Technical Guidelines influenced by current technological ability, and how do they influence technology in turn?

3) How do the decisions of the Commission (a technical body) influence the final legal outer continental shelf boundaries?

2. BURDEN OF PROOF

A) Is there a burden of proof that a coastal State has to meet in order to pass the Commission's scrutiny?

In 1999, the Commission on the Limits of the Continental Shelf issued scientific and technical guidelines to assist coastal States wishing to make a claim over the extended continental shelf.[18] The aim of the guidelines was to clarify the "scope and depth of admissible scientific and technical evidence to be examined by the Commission during its consideration of each submission for the purpose of making recommendations…"[19] The guidelines, the Commission states, were necessary because of the strange mesh of technology and law in the outer continental shelf context. In short, the LOS Convention, specifically Article 76, made "use of scientific terms in a legal context which at times [departed] significantly from accepted scientific definitions and

[18] These guidelines were not simply intended to aid submitting coastal States, however: "The Guidelines, which the Commission adopted by consensus, serve multiple purposes: they are primarily intended to assist coastal States in preparing their submissions. They are also designed to provide an important scientific and technical reference for the consideration of these submissions and the preparation of the Commission's own recommendations. And last but not least, they form the basis on which the Commission shall provide advice, if requested by coastal States during the preparation of their necessary data." Commission on the Limits of the Continental Shelf, *Scientific and Technical Guidelines of the Commission on the Limits of the Continental Shelf*, CLCS 11, Adopted 13 May 1999. Preface. Retrieved from the World Wide Web August 22, 2001
http://www.un.org/Depts/los/clcs_new/documents/CLCS_11.htm

[19] Ibid., p.4

terminology."[20] While the Guidelines establish various hierarchies of evidence,[21] and suggest useful technologies to claimant States, they incorporate no clear, precise burden of proof a coastal State's claim must meet in order to pass the scrutiny of the Commission.

The lack of a burden of proof is consistent with the role assigned to the Commission under Article 76. This role becomes clearer by examining the detailed wording of Article 76 (8) where it provides that the Commission "is to make recommendations" to the submitting State "on matters related to the establishment of the outer limits of the continental shelf." The making of recommendations is <u>not</u> the passing of judgment on the validity of an outer limit line. The Commission is not imbued with the authority of a court of law to decide upon the bona fides of an outer limit claim.

Article 76 does not indicate what the responsibilities are of a submitting State after receiving "recommendations" of the Commission, although Annex II, Article 8 requires a coastal State which disagrees with the "recommendations" to make a revised submission to the Commission. There is the potential of a ping-pong result between the Commission and the submitting State the end of which is not established in the LOS Convention.[22] Article 76 (8) further provides that: "The limits of the shelf established by a coastal State on the basis of these recommendations shall be final and binding." A 1980 government of Canada statement sheds some light on this sentence of Article 76 (8) and perhaps more generally on the "ping-pong" effect:

> The…Commission is primarily an instrument which will provide the international community with reassurances that coastal States will establish their continental shelf limits in strict accordance with the provisions of article 76. It has never been intended, nor should it be intended, as a means to impose on coastal States limits that differ from those already recognized in article 76. Thus to suggest that the coastal States limits shall be established "on the basis" of the commission's

[20] Commission on the Limits of the Continental Shelf, *Scientific and Technical Guidelines of the Commission on the Limits of the Continental Shelf*, § 1.3. CLCS 11, Adopted 13 May 1999. Retrieved from the World Wide Web August 22, 2001 http://www.un.org/Depts/los/clcs_new/documents/CLCS_11.htm

[21] See Section III, below.

[22] Experts disagree on just how long this submission-recommendation-resubmission process would continue. The Commission cannot "impose a boundary line…" [Gardiner, 1987, p. 69], and some would argue that there are various possible outcomes should the coastal State refuse to accept the recommendations of the Commission. [Gardiner, 1987, p. 69]. Others mention that "[t]heoretically, this [ping-pong] process could go indefinitely." [Smith and Taft, 2000, p. 20].

recommendations rather than on the basis of article 76, could be interpreted as giving the commission the function and power to determine the outer limits of the continental shelf of a coastal State. We are assured on all sides that this is not the intention ….[23]

Without clear wording in Article 76, the only reasonable conclusion given the political nature of ocean boundaries is that it is the submitting State that has the final say on its outer limit determination. The Commission may relate to the international community that the outer limit boundary is at odds with the Commission's understanding of Article 76. It is up to the international community (or more properly individual States within the community) to decide on their own whether to accept or not the outer limit boundary proclaimed by a State. In an alternative scenario, if the Commission and a submitting State concur respecting the location of the outer limit, this does not have the result that the international community or individual States must of necessity accept and/or respect that outer limit.

It is evident that the role of the Commission is to assist the claiming State, where such assistance is necessary, in making its Article 76 claim and to assist the international community (the non-claiming States) by providing to the international community an objective analysis of whether the submitted claim of an outer limit meets the criteria set out in Article 76. One can describe this role of the Commission as that of a legitimator. Where a coastal State and the Commission are generally in accord with the location of an outer limit this will provide great legitimacy to that boundary and make challenges of the boundary more difficult. A coastal State outer limit not in accord with Commission recommendations will be less legitimate and more open to challenge by other States or perhaps even in the International Seabed Authority.

In short, a submitting State does not face a proof burden when submitting information to the Commission, but rather it faces a situation of the Commission conferring on the submitting state's claim a greater or lesser degree of legitimation. Given the uncertainties that exist both in the five different delineation methods outlined in UNCLOS[24] and in the technologies used to evidence these methodologies, States need to be aware of how to meet these uncertainties in order to increase the legitimation of their claims in the eyes of the Commission.

---

[23] Written Statement by the Delegation of Canada Dated 2 April 1980, UN Doc. A/Conf. 62/WS/4 United Nations, Third Conference on the Law of the Sea, Ninth Session, New York.

[24] UNCLOS Article 76(4-7). These are outlined in Table 2.1, below, and include the allowance for evidence to the contrary found in UNCLOS Article 76(4)(b).

There are some grave uncertainties inherent in the application of current technology to the Article 76 delimitation framework. These can be described by the following table:

Table 2.1 after Monahan and Wells, 2001. Showing the range of uncertainty in the location of the various components of Article 76.

ELEMENT	COMPONENTS	DISCIPLINE	UNCERTAINTY
350 M	baselines distance	hydrography geodesy	Kms and metres
2500 m contour plus 100 M	depth contouring distance	hydrography geodesy	100s of metres
Foot of the Slope plus 60 M	bottom morphology distance	hydrography geodesy	kms
Foot of the Slope sediment thickness	bottom morphology sediments	hydrography geophysics	kms
Evidence to the Contrary	bottom morphology structure	geology geophysics	tens of km

As Table 2.1 shows, the positional uncertainties inherent in the various elements that can contribute to the outer limit range from metres to tens of kilometres. There are different reasons for this. The outer constraint of 350 M can have large uncertainties based on the strategic, non-technical decision to include or not include straight baselines, and much smaller uncertainties based primarily on the technological limitation of how well the tide can be measured.[25] Uncertainty in the 2500 m contour plus 100 nautical miles of 100s of metres is derived from the use of International Hydrographic Organisation's current standard (IHO, 1998), which Monahan and Wells[26] argue has not kept pace with technology and can be rewritten to reduce this uncertainty considerably. The uncertainty associated with these two components of the Outer Constraint pales in comparison with the uncertainty associated with finding and locating the Foot of the Slope. UNCLOS Article 76 considers the Foot of the Slope as a geomorphic feature;[27] on the real earth, it is a feature that might not exist, and where it does exist, it can possess a very variable nature. Article 76 deals with the possibility of non-existence through the "evidence to the contrary" clause.[28] The

[25] Monahan et al, this volume.
[26] Monahan and Wells 2001a, 2001b, this volume.
[27] UNCLOS Article 76(4)(a).
[28] UNCLOS Article 76(4)(b).

CLCS insists that Coastal States first search for a Foot of the Slope and must document their failure to find one before attempting to use evidence to the contrary.[29]

The Commission will need to apply some type of objective standard in evaluating the information provided by a submitting State. That standard, yet unarticulated by the Commission, has been set out in the 1993 U.N. Division for Ocean Affairs and the Law of the Sea publication *The Law of the Sea Definition of the Continental Shelf*[30] (hereinafter the "Definition"). This document proposes the following: "the Commission must be satisfied that the data submitted truly reflect the geological/geomorphological conditions claimed."[31]

A literal application of a "truly reflect" standard, while meeting a scientific desire for certainty, would require informational sophistication beyond the reach of all but the wealthiest States. A literal application of "truly reflect" is also inconsistent with the general thrust of Article 76, which is that of outer limit finality provided the claim is not exaggerated. Yet, what the Commission is to examine is the relationship of the information submitted with the criteria of Article 76 – does the information, within reason, "truly reflect the … geomorphological conditions claimed …."

Currently, the Commission seems to have adopted a flexible approach. The Guidelines indicate that as long as coastal States makes use of the Commission guidelines to collect data about their claim, the Commission should be reasonably satisfied.[32] The Guidelines allow submitting States the use of different methodologies in most instances,[33]

---

[29] One possible sequence of events, then, is that a Coastal State could attempt to delineate its Foot of the Slope using Single Beam Echo Sounding (SBES), fail to find it, resurvey the Continental Slope using Multi Beam Echo Sounding (MBES), again fail to find a Foot of the Slope, and then be forced to increase the intensity and scope of its technology to include the full range of geological and geophysical data collection methodology.

[30] United Nations, Division for Ocean Affairs and the Law of the Sea, *The Law of the Sea: Definition of the Continental Shelf*, (New York, UN Sales No. E.93.V.16, 1993).

[31] Ibid, §V(83).

[32] See Note 18, above.

[33] This is borne out by § 1.4 of the Guidelines, in which the Commission states: "These Guidelines are not intended to exhaust the full range of possible methodologies contemplated by States…. the Commission has endeavoured to emphasize those which might minimize costs and result in the optimization of existing information and resources." One exception to this generality lies in § 4.2.1 of the Guidelines, which states the "complete bathymetric database used in the delineation of the 2,500 m isobath may *only* include a combination of the following…" (*emphasis added*) and goes on to list six methodologies acceptable to the Commission.

specifying only what technologies and methodologies are preferred.[34] This flexible approach is not only a valid approach, given the diversity of economics, available technology and size of claim among the coastal States, but is also consistent with the history and context of the role of the Commission and Article 76 more generally. However, the flexibility of the Guidelines may leave some claimants (or at least their scientists) questioning what information they will have to provide to the Commission in order to satisfy the Commission's scrutiny.

3. HIERARCHIES OF EVIDENCE IN THE GUIDELINES OF THE COMMISSION ON THE LIMITS OF THE CONTINENTAL SHELF

A) In what ways did the accuracy and precision of various technologies influence these hierarchies?

A second way in which law and policy are influencing one another in the continental shelf regime is apparent in the hierarchies of acceptable evidence in the Commission Guidelines.[35] For example, in section 4.2 of the Guidelines, the Commission makes an exhaustive[36] list of the of the data types it will accept in the delineation of the 2,500 m isobath. The Commission also states that only single- and multi-beam echo sounding measurements will be considered as primary sources of evidence in this delineation,[37] with some exceptions in special circumstances.[38] The Guidelines also create a further layer to the hierarchy by declaring other technologies to be unacceptable, (thus the three hierarchical layers are: (1) primary, (2) complementary, and (3) unacceptable). These hierarchies are based on the confidence that the

[34] For example, § 4.2.2 of the Guidelines specifies which methods will be considered primary sources of information, and which ones as merely complementary for the delineation of the 2,500 m isobath; § 4.2.3 lists some exceptions to these rules.

[35] By way of example, hierarchies are evident in sections 4.2, 5.2, and 8.2 of the guidelines. CLCS, *Scientific and Technical Guidelines of the Commission on the Limits of the Continental Shelf*, CLCS 11, Adopted 13 May 1999. Retrieved from the World Wide Web August 22, 2001 http://www.un.org/Depts/los/clcs_new/documents/CLCS_11.htm

[36] The Commission states, in § 4.2.1 of the guidelines, that only a combination of single-beam echo sounding measurements, multi-beam echo sounding measurements, bathymetric side-scan sonar measurements, inferometric side-scan sonar measurements, and seismic reflection-derived bathymetric measurements may be included in the database used to delineate the 2,500 m isobath.

[37] CLCS Guidelines § 4.2.2.

[38] CLCS Guidelines § 4.2.3. One special circumstance noted by the Commission in this section is the case of ice-covered areas, in which case the Commission will accept "bathymetric information derived form seismic reflection and inferometric side-scan sonar…" as the primary source of evidence.

authors of the Guidelines collectively place in the accuracy and reliability of data gleaned from these various technologies.[39]

B) How much of a role does data density play in these hierarchies of evidence?

Interestingly, the hierarchies in the Commission Guidelines only mention data density in connection with seismic evidence.[40] For example, the hierarchy specified in § 4.2 of the Guidelines suggests that echo sounding measurements are superior to bathymetric and inferometric side-scan sonar measurements, but says nothing about how much of each data type the Commission considers necessary to evaluate a claim. It is therefore conceivable that the Commission only requires a very few measurements from its preferred technology, and that the rest of the claim could be made based on the "complementary information" highlighted in each hierarchy. Furthermore, it is possible that denser measurements using a less accurate technology would present a more complete picture of a claim than a few primary source measurements, and could result in considerable cost savings. Perhaps this should be taken into account when considering the evidence presented in a claim.

C) In what ways do the hierarchies of evidence preferred by the Commission influence the technology used to make a claim?

Overall, in fact, the Commission does seem amenable to portions of a claim being based solely on complementary data.[41] When coupled with the data density considerations outlined above, this suggests that complementary technologies could be used exclusively for large portions of the claim, potentially at a lesser cost. However, the Commission has clearly stated its preference for the primary sources of evidence.[42] Particularly in the case of the first few claims, when the ultimate significance of data sources is less clear, the language in the Guideline hierarchies will inevitably lead to some cost-benefit analysis by the

[39] This leads back to the question of what information is required to receive Commission legitimation. Although the Commission obviously finds some sources of data more reliable than others, it does not always require that comprehensive data from the primary sources of evidence be available. In § 8.2.1 of the guidelines, the Commission points out that "complementary forms of evidence are particularly relevant in instances where only a non-comprehensive seismic database may be available." This suggests that although some more expensive and more reliable data sources may be available, a large portion of a claim could be based on the less reliable, and therefore sometimes less expensive, techniques.
[40] There is a minimum data coverage suggested for seismic lines under § 8.2.21 of the Guidelines
[41] See Note 39, above.
[42] CLCS Guidelines § 4.2.2.

claiming coastal States. A coastal State must ask itself whether it will be less expensive to use the "best" technology (i.e., the Commission's "primary source of evidence") in the first place, rather than using a complementary technology and being asked to re-submit as a result.[43]

This will, no doubt, have some influence over the technologies used to make a claim. In fact, it may even result in changing the focus of technological development, so that as more nations start to make claims to the outer continental shelf, the technologies preferred by the Commission develop more rapidly in response. This could not only stunt the progress of the less preferred technologies, but also discourage the development of new tools, particularly where the Commission has made its lists of acceptable evidence exhaustive, as in § 4.2.1 of the Guidelines.[44]

D) Are the hierarchies of evidence outlined in the Commission Guidelines effective, or does it depend on the goal of the claiming State?

The Commission Guidelines are based on the presumption that every claiming State will find it worthwhile to use the best available technology in order to maximize their claim.[45] This raises the following question: What if a State did not find it valuable to spend the extra money in order to obtain data from the Commission's primary sources? In these circumstances, the Guideline hierarchies become less effective as a tool on which to base a technological choice. If such a State arrived before the Commission with only complementary sources of data, how would the Commission respond? Should it recommend that the claimant State acquire data from the primary sources? If the claimant State were to argue that the data already at its disposal was sufficient for its non-maximization purposes, and refused to obtain primary source data, it is somewhat unclear how the situation would be resolved.[46]

---

[43] Under UNCLOS Annex II, Article 8, claiming States must re-submit if disagree w/ Commission recommendations.

[44] This influence will, of course, depend on the number States that actually make a claim, the size of the claims, and how strictly the Commission adheres to its hierarchies of evidence in the first few cases.

[45] In fact, Australia seems to be doing just that. Symonds, Philip A. et al, 1998. "The Outer Limits of Australia's Resource Jurisdiction off Western Australia," In Purcell, PG and RR (Eds.), *The Sedimentary Basins of Western Australia*. 2. Proc Petroleum Exploration Soc. Of Australia Symp., Perth.

[46] See Note 22, above.

4. CANADA'S ORPHAN KNOLL: A SPECIFIC EXAMPLE

A) What data currently exists on Canada's Orphan Knoll? (A preliminary look.)

If Canada wanted to make a claim now, without spending additional funds, could it do so and fulfill the Commission's legitimation criteria and evidence hierarchy requirements? The evaluation of available data over a small portion of the continental shelf is useful to help analyze the answer to this question. Examining simply the data types available, without looking at the specific accuracies and uncertainties associated with them, we turn to Canada's Orphan Knoll. Orphan Knoll is an elevated area in the Atlantic Ocean east of the island of Newfoundland (figure 4.1, below).

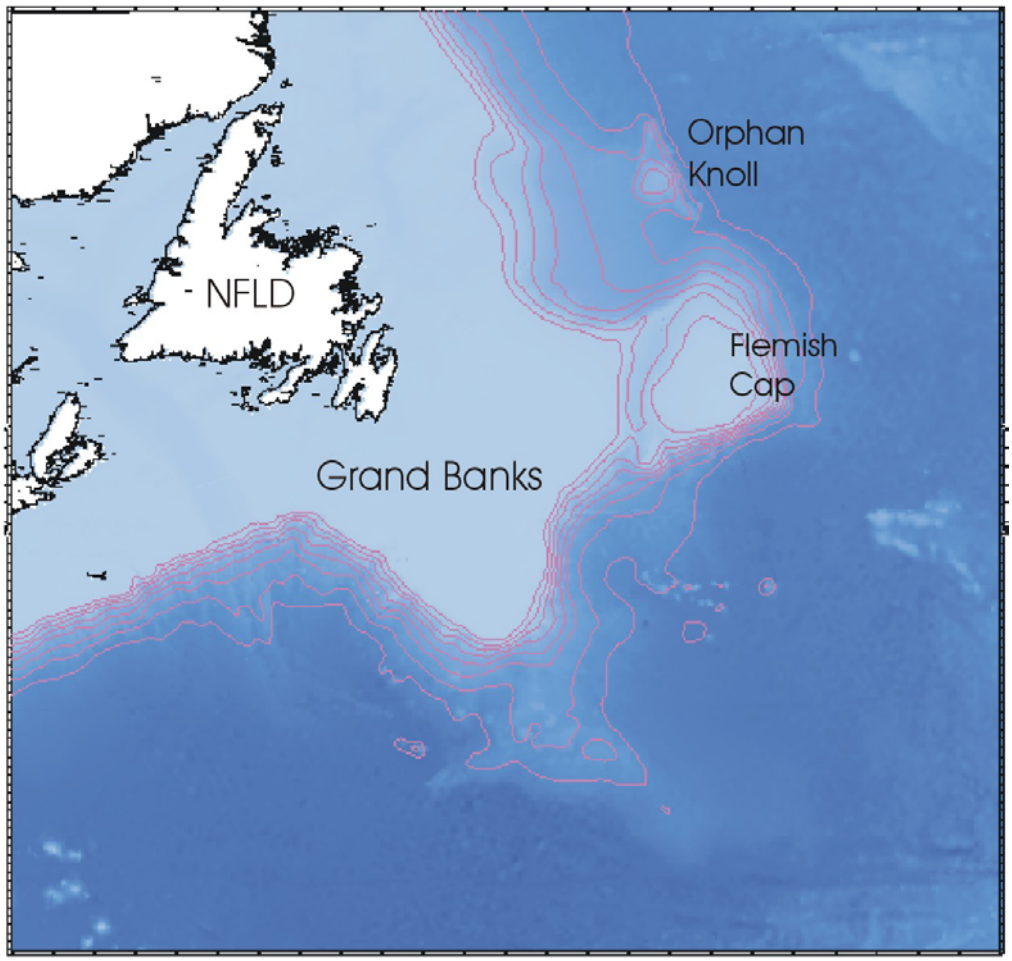


Figure 3.1: (Figure 4.1 in original publication) – Map showing the position of Orphan Knoll

Currently, Canada has access to the following data on Orphan Knoll:

Table 4.1 – Current Orphan Knoll Data Pertinent to a continental shelf claim

DATA TYPE	DATA SOURCE
International Bathymetry maps	GEBCO, ETOPOV
Canadian bathymetry maps	In the Natural Resource Series
Bathymetry data	Single beam echosounder tracks, mostly randomly distributed in space and collected over a number of years
Seismic data	A few seismic tracks collected in the 1970s to support DSDP drilling
Drill cores	From a DSDP Hole
Magnetic data	Collected in conjunction with the SBES tracks
Gravimetric data	Collected in conjunction with the SBES tracks

B) Could the current data fulfill the hierarchies of evidence articulated by the Commission?

As stated in Section 3 of this paper, while the Guidelines establish various hierarchies of evidence, and suggest useful technologies to claimant States, they create no clear, precise burden of proof a coastal State's claim must meet in order to pass the scrutiny of the Commission. A submitting State merely faces a situation of the Commission conferring on the submitting state's claim a greater or lesser degree of legitimation. Because the Guidelines allow the use of many different technologies with various (sometimes very large) uncertainties associated with them, the claiming State acting pursuant to the Guidelines only seems to be asked to show (in order to gain Commission legitimation) that its claim is not outrageous, taking into account today's technologies and their associated costs.

Given the Commission's flexibility, due to its Article 76 role, the best we can do is to see how closely our data fulfills the Commission's Guideline requirements. This test also handily answers the question of how closely current Orphan Knoll data fits within the hierarchies of evidence articulated in the Guidelines. For these purposes, we will examine the data with respect to three hierarchies: § 4.2, § 5.2, and § 8.2.

Table 4.2 – Data Types Allowed in § 4.2 v. Current Orphan Knoll Data

DATA TYPES ALLOWED IN § 4.2: DELINEATION OF THE 2,500 M ISOBATH	DO WE HAVE THIS TYPE OF DATA FOR ORPHAN KNOLL?
Single beam echo sounding measurements (primary)	Yes
Multi beam echo sounding measurements (primary)	No
Bathymetric side scan sonar measurements (complementary)	No
Inferometric side scan sonar measurements (complementary)	No
Seismic reflection-derived bathymetric measurements (complementary)	A couple of seismic data tracks

Table 4.3 – Data Types Allowed in § 5.2 v. Current Orphan Knoll Data

DATA TYPES ALLOWED IN § 5.2: IDENTIFYING THE BASE OF THE CONTINENTAL SLOPE (MAY BE ONE OR A COMBINATION, BUT ONLY BATHYMETRIC DATA USED TO DETERMINE THE MAXIMUM CHANGE IN GRADIENT AT THE FOS)	DO WE HAVE THIS TYPE OF DATA FOR ORPHAN KNOLL?
Single beam echo sounding measurements	Yes
Multi beam echo sounding measurements	No
Hybrid side scan sonar measurements	No
Inferometric side scan sonar measurements	No
Seismic reflection-derived bathymetric measurements	A couple of seismic data tracks

Table 4.4 – Data Types Allowed in § 8.2 v. Current Orphan Knoll Data

DATA TYPES ALLOWED IN § 8.2: DETERMINING SEDIMENT THICKNESS	DO WE HAVE THIS TYPE OF DATA FOR ORPHAN KNOLL?
Seismic reflection survey data (primary)	A couple of seismic data tracks
Seismic refraction survey data (primary)	A couple of seismic data tracks
Bathymetric side scan sonar measurements (complementary)	No
Gravimetric data (complementary)	Yes
Magnetic data (complementary)	Yes
Complementary data (complementary)	Drill cores

Using the above tables it does seem that Canada's current data on Orphan Knoll would sufficiently fulfill the hierarchy of evidence requirements for the Commission for these sections of the Guidelines. Given that this data could arguably fulfill even the data density requirements articulated in § 8.2.21 of the Guidelines for seismic lines,[47] it is conceivable that Canada could enter a claim to Orphan Knoll without collecting any further data.

5. TECHNICAL EXPERTISE IN A LEGAL FRAMEWORK

A) How do the Commission's actions (those of a technical body) intertwine with the law?

The most obvious way in which the technical decisions of the Commission (a technical body) affect and are affected by the law rests in the Guidelines themselves. The Guidelines contain the Commission's interpretation of legal terms.[48] The technical expertise of the Commission members has been brought to bear in order to arrive at the hierarchies of evidence in the Guidelines.

However, a few questions about the Commission's power under the law remain. A draft of a preliminary report by the ILA Committee on

[47] The "Full bathymetric models" required under § 4.3.5 of the Guidelines could be produced using current bathymetric data sets.
[48] Commission Guidelines, § 1.3.

Legal Issues of the Outer Continental Shelf[49] poses the following question: "What is the meaning of the words 'on the basis of' the recommendations of the CLCS contained in article 76(8) of the LOS Convention?"[50] Indeed, should a dispute arise about whether a claim has been made "on the basis of" the Commission's recommendations, who would determine whether the test of "on the basis of" had been met?[51] Would the technical body (the Commission) be able to answer that question, or would a legal entity have to be invoked to settle the dispute?

Furthermore, as the ILA Committee points out, does the fact that claims established on the basis of the Commission's recommendations are final and binding[52] mean that all other outer limit lines invalid *per se*?[53] As we can see from the legal complexity of these questions, while the Commission, a technical body, is interpreting and evaluating extended continental shelf claims based on the law, the law may continue to influence its decisions in unforeseen ways.

6) CONCLUSION

As this paper has shown, technical and legal uncertainties affect one another in many ways on the extended continental shelf. The Commission's role as legitimator of claims, hierarchies of evidence, and the overall structure of extended continental shelf claim evaluation are examples of the ways in which policy and technology display intertwined uncertainties in this regime. Based on even these links alone, it would be a misconstruction to attempt to entirely separate technological uncertainties from legal/political uncertainties in the case of the juridical continental shelf.

Legal uncertainties in this case do not rest exclusively in the language of the law. The truth is that technology and its accompanying uncertainty is now playing a role not only in the development of continental shelf policy, but also, because science is written into the law,

[49] ILA Committee on Legal Issues of the Outer Continental Shelf, Preliminary Report on the Limits of the Outer Continental Shelf (Draft), Prepared by Dr. Alex G. Oude Elferink, Utrecht University, Utrecht, the Netherlands, 4 September 2001. This is only a draft document.
[50] Ibid, p.9
[51] Ibid, p.9
[52] UNCLOS Article 76(8).
[53] ILA Committee on Legal Issues of the Outer Continental Shelf, Preliminary Report on the Limits of the Outer Continental Shelf (Draft), Prepared by Dr. Alex G. Oude Elferink, Utrecht University, Utrecht, the Netherlands, 4 September 2001. P. 9. This is only a draft document.

> in the execution of a claiming State's legal obligations. The technological and legal uncertainties involved in an extended continental shelf claim are inexorably intertwined, and must be evaluated together in order to fully understand the outer continental shelf regime.

End of Extract

3.3 Testing UNCLOS in the Hypothesized Legal Framework

Since the reasons for choosing this case study have already been discussed in section 3.1, what remains is to examine this case study to see whether it fits within or changes the hypothesized legal framework of Figure 2.4. Does this international convention (A) affect the management and governance of property interests; (B) affect the use of established and emergent technologies and methodologies; and/or (C) affect the management of spatial information?

3.3.1 UNCLOS Article 76 and the Administration of Property Interests

3.3.1.1 UNCLOS' Influence on the Governance and Administration of Property Interests

Property interests are usually thought of as the domain of private entities. However, UNCLOS specifically contemplates and addresses the property interests of nations.

The first question to address is whether Article 76 influences the governance and management of these property interests. The answer is that it definitively does. It

codifies the powers a ratifying coastal nation will wield over its outer continental shelf. The data collected to formulate an outer continental shelf claim will eventually dictate the amount of territory a coastal nation can administer. UNCLOS, it seems, will dictate the outer limit of any national marine cadastres of ratifying countries, since national sovereign interests extend only to the bounds described in Article 76.

Furthermore, Article 76 sets up the Commission on the Limits of the Continental Shelf, a separate technical administrative body to make recommendations and to provide scientific and technical advice *based on the law*. This will in turn influence the way in which a nation establishes its outer boundary under UNCLOS. It sets up an administrative procedure previously unheard of in ocean boundary-making, and establishes steps or potential administrative hurdles which ratifying nations much abide by in order to establish the limits of their extended continental shelves. Although the exact limits of the Commission's powers are still open to interpretation, there is no question that a nation must at least submit its claim to them for recommendations, a new step in ocean boundary-making.

3.3.1.2 The UNCLOS Case Study Alters the Hypothesized Framework as to Governance and Administration of Property Interests

The second question is whether the UNCLOS case-study indicates a change in the hypothesized legal framework. The distinct differences between the first UNCLOS Case Study and the Marine Cadastre Case Study are obvious, and have an effect on the answer to this question. The potential limitations of the marine cadastre case-study are

detailed in section 2.5. One major limitation is that without a current marine cadastre to examine, it is impossible to determine with any certainty how outer forces may influence its creation and contents. Furthermore, the marine cadastre concept does not enjoy the same world-wide long-term history as the United Nations Convention on the Law of the Sea. In the case of UNCLOS, it is evident that while its establishment may influence the governance and administration of marine property interests, the administration of these interests also influenced its creation and development.

3.3.1.3 Historical Development of Continental Shelf Governance and Administration

While some nations, such as Peru, Chile, and Ecuador [Sohn and Gustafson, 1984, P. 116-117] claimed complete sovereignty of the seabed, subsoil, and superadjacent waters up to 200 nautical miles before the ratification of UNCLOS, the Truman Proclamation of 1945 "…has been acknowledged by the International Court of Justice as being 'the starting point of the positive law on the subject [of the continental shelf]'" [Sohn and Gustafson, 1984, P. 151]. In 1953 the Outer Continental Shelf Lands Act [43 U.S.C. 1331 et seq.] was enacted in the United States to regulate the exploitation and exploration of the continental shelf, and other nations passed similar laws. [Sohn and Gustafson, 1984, P. 152]. The principles embodied in these Acts were incorporated first into the 1958 Convention on the Continental Shelf, and subsequently into UNCLOS. [Sohn and Gustafson, 1984, P. 152-153].

3.3.1.4 UNCLOS Article 76: A New Framework Arrow Required

While UNCLOS solidifies these principles in international law, and in some cases refines and expands them, it is evident that the early development of these principles greatly influenced its current content. Although a nation's continental shelf may now extend beyond 200 nautical miles given the proper circumstances, what rights that nation may exercise over its continental shelf were based on earlier laws developed by individual nations. It is clear that the earlier administration and governance of a nation's rights over its continental shelf influenced the contents of the international convention. As a result, a new arrow must be added to the framework diagrams, as shown first in figure 3.1. Its dashed line indicates that this influence may not always exist, as there may be cases where there is no administration of marine property interests before a law is enacted:

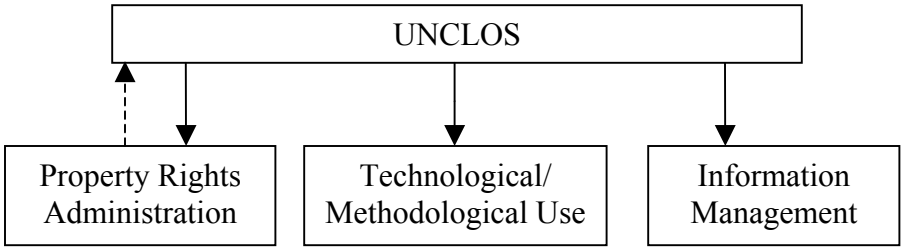


Figure 3.2: The additional administration arrow after the UNCLOS Case Study

This figure, in turn, changes the overall legal framework described in section 2.4 as follows:

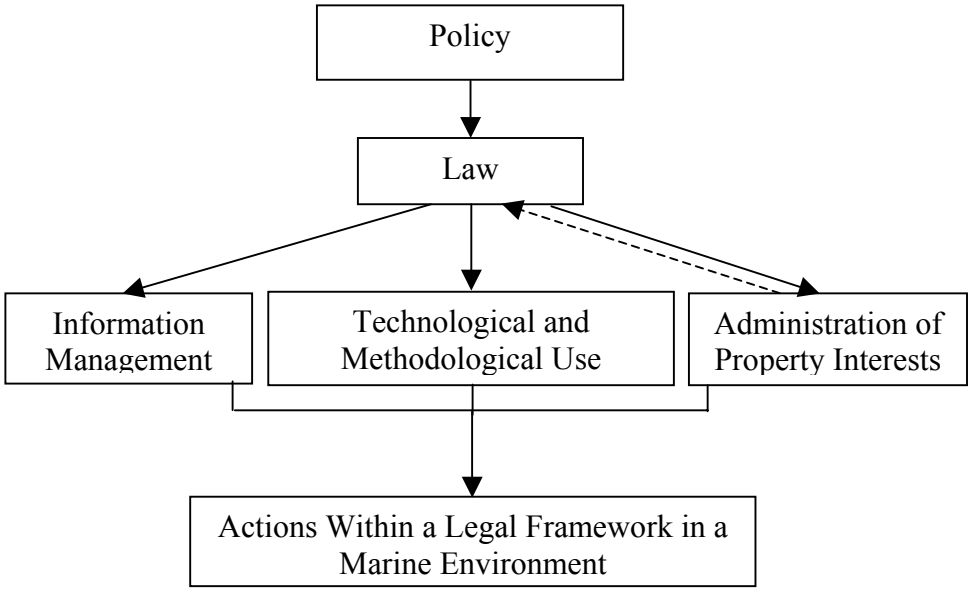


Figure 3.3: The Framework after the UNCLOS Case Study, Part I

Again, the dashed nature of this line indicates that this influence may not always exist.

3.4 UNCLOS Article 76 and the Use of Technology and Methodology

3.4.1 UNCLOS' Influence on the Use of Technology and Methodology

The Commission on the Limits of the Continental Shelf is a unique body in the arena of ocean boundary-making. This is true for several reasons, not least of which is that it is a technical body comprised of "…experts in the field of geology, geophysics or hydrography…" [UNCLOS Annex II, Article 2(1)], who are fulfilling an administrative requirement of the Convention. As described above, the guidelines issued by the

Commission may influence technological and methodological use for extended continental shelf claims in several ways. The Commission's clear preference for primary sources of evidence will force coastal nations to analyze whether it will be less expensive to use a primary source of evidence in the first place, "rather than using a complementary technology and being asked to re-submit as a result." [Cockburn et. al., 2001]. This will occur despite the fact that "the Commission does seem amenable to portions of a claim being based solely on complementary data." [Cockburn et. al., 2001]. The Scientific and Technical Guidelines will, as a result, have some influence over the technologies and methods a coastal nation chooses to use to gather evidence for a claim, and may, in the long run, influence technological development in certain areas.

3.4.2 The UNCLOS Case Study Alters the Hypothesized Framework as to Technological and Methodological Use

It is clear that Article 76 will influence the technologies chosen to gather evidence for an extended continental shelf claim. However, current technological capability also influenced the Commissioners in the establishment of their scientific and technical guidelines. The Commissioners' technical expertise has been brought to bear in order to arrive at the hierarchies of evidence in the Guidelines. These hierarchies clearly separate the methods of evidence gathering into three hierarchical layers: (1) primary, (2) complementary, and (3) unacceptable. "These hierarchies are based on the confidence that the authors of the Guidelines collectively place in the accuracy and reliability of data gleaned from these various technologies." [Cockburn et. al., 2001].

Given that the technology available influenced the formulation of the Scientific and Technical Guidelines of the Commission on the Limits of the Continental Shelf, it is evident that there may be cases in which available technology and methodology influence the formulation of the law surrounding marine boundaries. Since that is the case, a new arrow must be added to the legal framework, as seen in Figure 3.4. Its dashed weight indicates that this influence may not always exist.

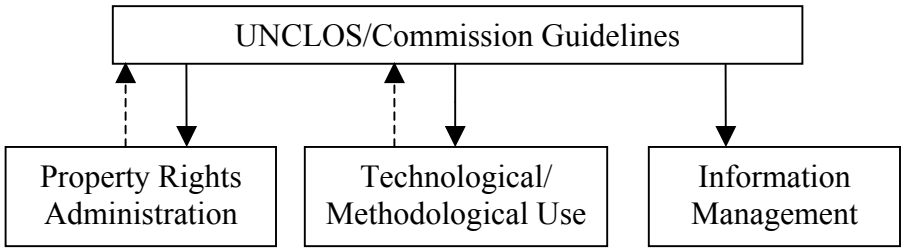


Figure 3.4: The additional technology arrow after the UNCLOS Case Study.

This translates into a new arrow in the overall legal framework, as shown in Figure 3.5; its dashed weight similarly indicates that this influence may not always exist.

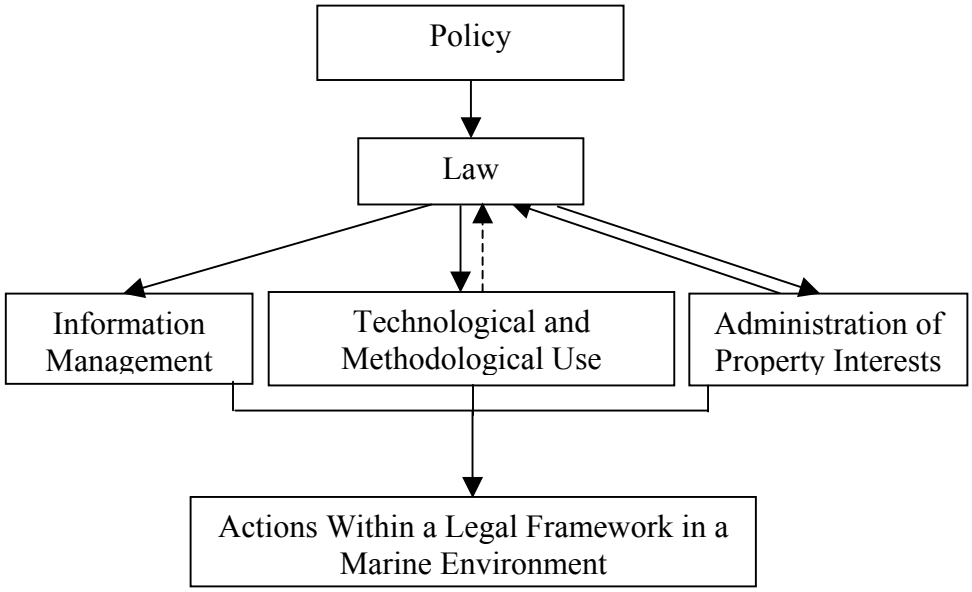


Figure 3.5: The Framework after the UNCLOS Case Study, Part II.

3.5 UNCLOS Article 76's Influence on the Management of Spatial Information

3.5.1 UNCLOS' Influence on the Management of Spatial Information

Article 76.8 and Article 76.9, and especially the Scientific and Technical Guidelines authored by the Commission on the Limits of the Continental Shelf, also influence the management of spatial information. First, the way data is prioritized and presented to the Commission on the Limits of the Continental Shelf will likely have bearing on the outcome of their review of the claim in question. Second, the way the CLCS manages the spatial information in question is dictated by their rules of procedure, which specify that the Commission will keep all requested data and submission documents safe, "[t]he Secretary-General shall ensure the safe custody of

the submission and the attachments and annexes thereto at United Nations Headquarters until such time as they are required by the Commission…," and also confidential. [CLCS, 2001, P. 13]

Furthermore, the process of filing a claim will alter whether the nation in question or the International Seabed Authority (ISA) will manage the spatial information for a given area. The ISA is "…an intergovernmental organization through which its members organize and control activities on the deep ocean floor in areas beyond the limits of national jurisdiction [called "the Area"], particularly with a view to administering the mineral resources of that area."[54] As such, the ISA will manage the spatial information of the Area.

3.5.2 The Influence of Desired Spatial Information Management Practices on the CLCS

The United Nations Convention on the Law of the Sea, first signed in 1982, had enough ratifiers to become law in 1996. The first session of the CLCS was held was held at United Nations Headquarters in New York, in June of 1997, although "…development of the Rules of Procedure on the issue of confidentiality [continued], resulting in the issuance of the revised Rules… in February 2001." [DOALOS, 2004]. In the same way extant technologies influenced the hierarchies established by the CLCS, it is clear that the information management issues facing the CLCS and their potential claimants prompted the inclusion of confidentiality or privacy clauses in their

[54] International Seabed Authority (date unknown). Retrieved from the World Wide Web on April 4, 2004. http://www.isa.org.jm/en/seabedarea/TechBrochures/ENG2.pdf

Rules of Procedure. This warrants the inclusion of a new dashed arrow in the framework, its dashed nature indicating that this influence may not always exist.

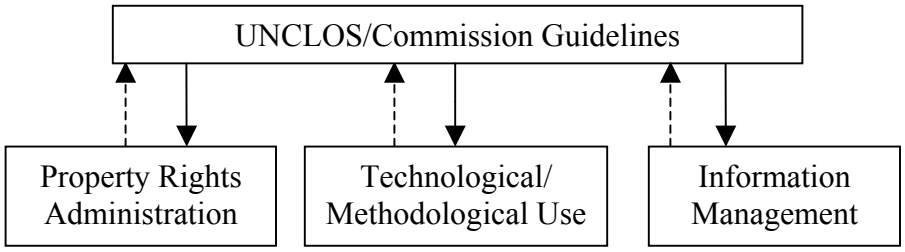


Figure 3.6: The additional information management arrow after the UNCLOS Case Study.

This translates into a new arrow in the overall legal framework, as shown in Figure 3.7, its dashed weight similarly indicating that this influence may not always exist.

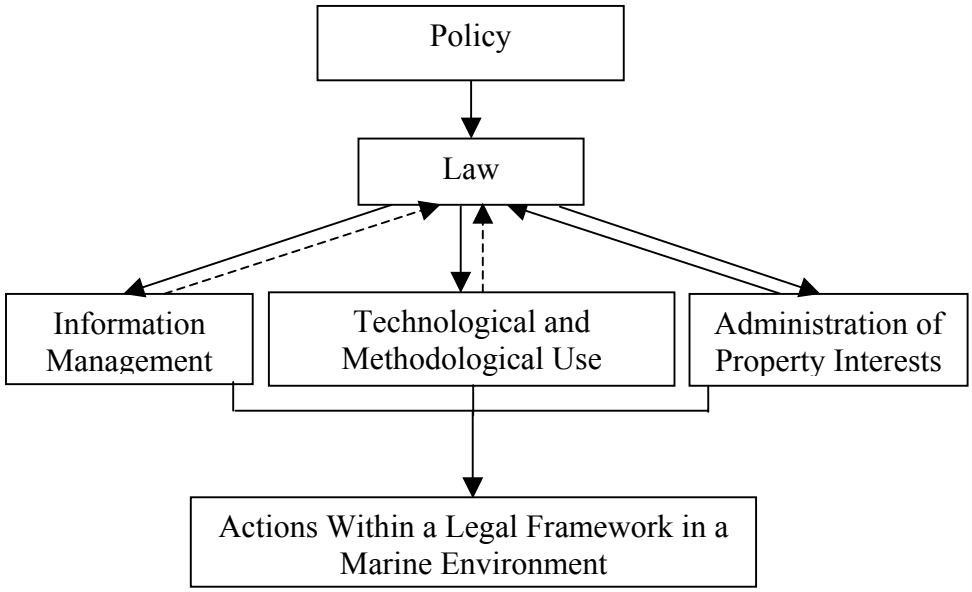


Figure 3.7: The Framework after the UNCLOS Case Study, Part III

CHAPTER 3 REFERENCES

ACKNOWLEDGEMENTS

The authors gratefully acknowledge the Geomatics for Informed Decisions (GEOIDE) network, http://www.geoide.ulaval.ca/, for their financial support. GEOIDE is a federally supported Network of Centres of Excellence.

REFERENCES

1982 LOS Convention opened for signature 10 December 1982, UN Doc. A/Conf. 62/122 reprinted in United Nations, Official Text of the United Nations Convention on the Law of the Sea with Annexes and Index (New York: UN Sales No. E83.V.5, 1983).

Black, H.C., 1990, *Black's Law Dictionary, 6th Edition*. (6th Edition by The Publisher's Editorial Staff – Coauthors J. R. Nolan and J. M. Nolan-Haley, Contributing Authors M.J. Connolly, S.C. Hicks, M.N. Alibrandi), West Publishing Company, St. Paul Minnesota.

Cockburn, S., S. Nichols, D. Monahan and T. McDorman (2001). "Intertwined Uncertainties: Policy and Technology on the Juridical Continental Shelf." In *Proceedings of the Advisory Board on the Law of the Sea to the International Hydrographic Organization (ABLOS) Conference "Accuracies and Uncertainties in Maritime Boundaries and Outer Limits."* Presented at the International Hydrographic Bureau, Monaco, October 2001. http://www.gmat.unsw.edu.au/ablos/COCKBURN.PDF

Commission on the Limits of the Continental Shelf, *Scientific and Technical Guidelines of the Commission on the Limits of the Continental Shelf*, CLCS 11, Adopted 13 May 1999. Retrieved from the World Wide Web August 22, 2001 http://www.un.org/Depts/los/clcs_new/documents/CLCS_11.htm

Commission on the Limits of the Continental Shelf (2001). *Rules of Procedure of the Commission on the Limits of the Continental Shelf*, New York, 21-25 May 2001. Retrieved from the World Wide Web April 4, 2004. http://ods-dds-ny.un.org/doc/UNDOC/GEN/N01/239/51/PDF/N0123951.pdf?OpenElement

DOALOS (2004). United Nations Division for Ocean Affairs and the Law of the Sea, "Purpose of the Commission." Retrieved from the World Wide Web April 4, 2004 http://www.un.org/Depts/los/clcs_new/commission_purpose.htm#Purpose

Gardiner, P.R.R., 1987, "The Limits of the Area Beyond National Jurisdiction – Some Problems With Particular Reference to the Role of the Commission on the Limits of the Continental Shelf," Chapter 5 in: *Maritime Boundaries and Ocean Resources*, G. Blake, Ed., Croom Helm, London & Sydney

Hardy, I.T., 1998, "Copyright Office Issues New Report on the Future of Copyright in a Networked World," *Information Today*, Vol. 15 Issue 9, P.33, Retrieved on 31 January 2001 the Academic Search Elite Database on the World Wide Web. http://ehostvgw16.epnet.com/

IHO, IOC and CHS, 1984, *GEBCO - General Bathymetric Chart of the Oceans* (5th Edition), International Hydrographic Organization/ Intergovernmental Oceanographic Commission/ Canadian Hydrographic Service, Ottawa, Canada.

ILA Committee on Legal Issues of the Outer Continental Shelf, 2001, *Preliminary Report on the Limits of the Outer Continental Shelf (Draft)*, Prepared by Dr. Alex G. Oude Elferink, Utrecht University, Utrecht, the Netherlands, 4 September 2001.

International Hydrographic Organization, 1998, *IHO Standards for Hydrographic Surveys*, IHB, Special Publication No. 44, 4th Edition.

International Seabed Authority (date unknown). Retrieved from the World Wide Web on April 4, 2004. http://www.isa.org.jm/en/seabedarea/TechBrochures/ENG2.pdf

Jones, M.T., 1997, "The GEBCO Digital Atlas; A Seamless, Digital, Bathymetric Contour Chart of the World's Oceans," *Hydro International*, Vol.1, No.5, pp.46-47.

Monahan, Dave and D E Wells, 2000, "IHO SP 44 Standards for Hydrographic Surveys and the Demands of the New Century," *Proceedings, Canadian Hydrographic Conference 2000*, Montreal. Un-paginated CD-ROM.

Monahan, D. and D. E. Wells, 2001a, "Deep Water Challenges to Hydrography Stimulated by the United Nations Convention on Law of the Sea (UNCLOS)," *US Hydrographic Conference*, 21-24 May, Norfolk, VA, un-paginated CD-ROM.

Monahan, D. and D. E. Wells, 2001b, "The Suitability of the International Hydrographic Organization's 'Standards for Hydrographic Surveys, Version 4' for Determining Depth Accuracy in the Scientific and Technical Guidelines of the United Nations Commission On The Limits Of The Continental Shelf." *Proceedings, International conference on Technical Aspects Of Maritime Boundary Delineation and Delimitation*. International Hydrographic

Organization, International Association of Geodesy, International Board on Technical Aspects of Law of the Sea (ABLOS), Monaco, 18-19 October 2001.

Monahan, D., S. Nichols, S. Ng'ang'a, and R. van de Poll (2001). "Assessing the Impact of Uncertainties in the Locations of 'baselines from which the breadth of the Territorial Sea is measured' on the Outer Limit of the Juridical Continental Shelf" In *Proceedings of the Advisory Board on the Law of the Sea to the International Hydrographic Organization (ABLOS) Conference "Accuracies and Uncertainties in Maritime Boundaries and Outer Limits."* Presented at the International Hydrographic Bureau, Monaco, October 2001. http://www.gmat.unsw.edu.au/ablos/ABLOS01Folder/MONAHAN.PDF

Pluijmers, Y. and H.J. Onsrud, 1997, "Commercial Sector Perspectives Regarding Legal Methods for Protecting Spatial Datasets," *Proceedings of GIS/LIS 1997*, 402-404, Retrieved on 2 February 2001 from the World Wide Web. http://www.spatial.maine.edu/~onsrud/pubs/comcopyrtabstract84.htm

Smith, R.W. and G. Taft, 2000, "Legal Aspects of the Continental Shelf," Chapter 3 in: *Continental Shelf Limits: The Scientific and Legal Interface*, P.J. Cook and C.M. Carleton, Eds., Oxford University Press.

Sohn, L.B. and K. Gustafson (1984), *The Law of the Sea in a Nutshell*. West Publishing Company, St. Paul Minnesota.

Symonds, Philip A. et al, 1998, "The Outer Limits of Australia's Resource Jurisdiction off Western Australia," In Purcell, PG and RR (Eds.), *The Sedimentary Basins of Western Australia*. 2. Proc Petroleum Exploration Soc. Of Australia Symp., Perth.

The Economist, 2001, "Stop Signs on the Web," *The Economist*, Jan 13th, 2001. Retrieved on 31 January 2001 from the World Wide Web. http://www.economist.com/PrinterFriendly.cfm?Story_ID=471742

Treaty Doc. 103-39, 103rd Congress, 2d Session, Senate, Message From the President of the United States, U.S. Government Printing Office, Washington, 1994.

United Nations, Division for Ocean Affairs and the Law of the Sea, *The Law of the Sea: Definition of the Continental Shelf*, (New York, UN Sales No. E.93.V.16, 1993).

Written Statement by the Delegation of Canada Dated 2 April 1980, UN Doc. A/Conf. 62/WS/4 United Nations, Third Conference on the Law of the Sea, Ninth Session, New York.

4: CASE STUDY III: THE NEWFOUNDLAND & LABRADOR – NOVA SCOTIA BOUNDARY ARBITRATION

4.1 The Selection of the NFLD – NS Boundary Arbitration Case Study

The study of the Newfoundland and Labrador (hereinafter referred to as Newfoundland) – Nova Scotia boundary dispute was selected for this thesis for several reasons. First, it is an extremely current case of marine boundary-making. Second, it is specific to Canada. Third, it is a different source of law than the United Nations Convention on the Law of the Sea, being an inter-provincial arbitration as opposed to an international convention. As the outcome of a binding arbitration, it has the hallmarks of Common Law precedent in the making, at least for Canada. Fourth and lastly, it is an arbitration of an administrative boundary for a particular purpose, as opposed to a jurisdictional or sovereign boundary. [Arbitration, 2002, P. 15]. As such, it deals with an entirely different type of marine boundary from the UNCLOS boundaries, but one which would have to be included in a comprehensive marine cadastre.

4.2 The Case: Its History and Development

Extracted from:

Cockburn, S. and S. Nichols (2002). "Factors in Inter-provincial Boundary Delimitation: Points of Interest for Surveyors in the Newfoundland & Labrador/Nova Scotia Boundary Arbitration." Contract report for Service New Brunswick, Fredericton, New Brunswick, November 2002.

The author of this thesis completed the first draft of this document and worked with Dr. Nichols on editing the draft for a final version.

4.2.1 The History of the Dispute

It is sometimes thought that a formal boundary between political entities is not required if no particular contest has arisen between the two. That is to say, if both are satisfied with their access to resources and territory, as well as their jurisdiction and administrative rights, and there is no conflict with their neighboring region over any of these things, why create a formal boundary whose mere creation could give rise to disputes? Therefore, when examining any political boundary, it is essential to have an understanding of how it came to be required, and the process behind its creation.

In the case of Nova Scotia and Newfoundland, three main events transpired which gave rise to the eventual arbitration. The arbitration's main purpose was to determine the provinces' shared boundary for the purpose of hydrocarbon revenue sharing.

4.2.1.1 The Atlantic Provinces Inter-Provincial Boundaries in 1964

In the 60s, with the possibility of vast revenues to be gained from offshore oil and gas development on the horizon, the four governments of the Atlantic Provinces were interested in making a joint claim to offshore territory. They jointly created lines representing provincial ownership of mineral resources offshore and their division among the provinces. The main reason for the joint enterprise was to present a united front and a common claim to the territory versus the Government of Canada. The lines were delineated on a map and a document entitled *Notes re: Boundaries of Mineral Rights as between Maritime Provincial Boundaries.* A Joint Statement issued by the Atlantic Premiers at this time stated that in the interest of this claim the boundaries described and depicted in the attached document and map were *"...the marine boundaries of the Provinces of Nova Scotia, New Brunswick, Prince Edward Island, and Newfoundland..."*[55] That same year Premier Smallwood *"...ordered that a plaque be placed on the seabed at the*

[55] *Arbitration Between Newfoundland and Labrador and Nova Scotia Concerning Portions of the Limits of Their Offshore Areas as Defined in the Canada-Nova Scotia Offshore Petroleum Resources Accord Implementation Act and the Canada-Newfoundland Atlantic Accord Implementation Act: Award of the Tribunal in the Second Phase.* Ottawa, March 26, 2002. P. 6. Retrieved from: http://www.boundary-dispute.ca, April 2002.

edge of the Newfoundland shelf, as if showing the boundaries of an area appertaining to the Province."[56]

A decision by the Supreme Court of Canada in 1967, however, upheld the federal view that *"ownership of submarine mineral rights beyond the land territory and internal waters of the provinces was vested in Canada and that accordingly no question of existing provincial boundaries arose…,"*[57] at least on the West Coast. The Atlantic Provinces then formed a Joint Mineral Resources Committee of the Atlantic Provinces, which prepared a more detailed description of the turning points described in *Notes re: Boundaries* which were now referenced to the North American Datum 1927 (NAD 27 - based on some coastline surveys, existing maps and charts, and creation of equidistant lines between shores)[58] and were depicted on a map. The Atlantic Premiers and the Vice-Premier of Quebec agreed upon the map and accompanying delineation in 1972. The Communiqué of the meeting stated *inter alia*:

4. THE FIVE EASTERN PROVINCES ASSERT OWNERSHIP OF THE MINERAL RESOURCES IN THE SEABED OFF THE ATLANTIC COAST AND IN THE GULF OF SAINT LAWRENCE IN ACCORDANCE WITH THE AGREED BOUNDARIES. [59]

The Federal government, however, while it was willing to consider revenue-sharing and joint-management scheme proposals, made it clear that in its opinion "sovereignty over the territorial sea vested in the Crown in right of Canada."[60] Prime Minister Trudeau also dismissed the request for a meeting to discuss these issues, saying *"…I do not think that such a meeting could usefully be directed to the points concerning jurisdiction, ownership and administration as outlined in your telegram…"*[61]

---

[56] Gault, I. T., "Jurisdiction Over The Petroleum Resources of the Canadian Continental Shelf: The Emerging Picture." *Alberta Law Review*, Vol. XXIII, No. 1. [1985], p. 82.

[57] *Arbitration Between Newfoundland and Labrador and Nova Scotia.* March 26, 2002. P. 6. This decision was *Reference re: Offshore Mineral Rights (British Columbia).*

[58] Some of the original computer calculations, maps, and notes were used as reference to create the New Brunswick maximum administration boundary in the GEOIDE project. See Sutherland, M, et al. (2002). "In search of New Brunswick's marine administrative boundaries." Accepted for presentation at the CIG-ISPRS Joint Symposium on Geospatial Theory, Processing and Application, Ottawa, July 2002.

[59] *Arbitration Between Newfoundland and Labrador and Nova Scotia.* March 26, 2002. P. 7

[60] Gault [1985], P. 81.

[61] *Arbitration Between Newfoundland and Labrador and Nova Scotia.* March 26, 2002. P. 7.

4.2.1.2 Newfoundland Seeks Clarification: Results of Part 1 of the Arbitration

During the 1970s there was much speculation on the value of offshore oil and gas development in Canada, especially as world oil prices began to rise dramatically. Newfoundland and Nova Scotia also saw the Atlantic resources as critical to future economic development. However, development was hindered due to the uncertainty about whether these resources were under federal or provincial ownership.

On October 6, 1972, Newfoundland sought clarification "of the 'present demarcation' vis-à-vis Nova Scotia…,"[62] and attached a copy of the 1964 map with an alternative boundary dashed in. The Tribunal in the first part of the arbitration held that Nova Scotia was from this point "put on notice that there was no agreement between the two provinces on the location of the southeasterly line."[63] In the second part of the arbitration, the Tribunal further held that "there was no 'sufficiently clear, sustained and consistent' conduct on the part of Newfoundland and Labrador to justify holding that it accepted the line in the inner sector."[64] Also, as to the outer area, the Tribunal held that "Newfoundland and Labrador's practice in relation to the supposed 135° boundary southeast of turning point 2017 does not sustain a claim of acquiescence, or support the view that the Parties regarded that line as equitable."[65]

4.2.1.3 The Atlantic Accords

The same uncertainty as to offshore ownership and jurisdiction eventually prompted Nova Scotia and Newfoundland to reach agreements with the Government of Canada. In 1982 the Premier of Nova Scotia and the Prime Minister signed the *Canada-Nova Scotia Agreement on Joint Management and Revenue Sharing*,[66] which promised Nova Scotia a revenue stream from offshore production, and which accepted the federal licensing scheme, administrative system and management regime for the offshore.[67] While the Province was allowed

---

[62] *Arbitration Between Newfoundland and Labrador and Nova Scotia.* March 26, 2002. P. 7
[63] *Arbitration Between Newfoundland and Labrador and Nova Scotia.* March 26, 2002. P. 7
[64] *Arbitration Between Newfoundland and Labrador and Nova Scotia.* March 26, 2002. P. 24
[65] *Arbitration Between Newfoundland and Labrador and Nova Scotia.* March 26, 2002. P. 25
[66] *Canada-Nova Scotia Agreement on Joint Management and Revenue Sharing* [1988, c. 28]. Consolidated Statutes and Regulations. Retrieved from: http://laws.justice.gc.ca/en/C-7.5/21662.html August 2001.
[67] Gault [1985], p. 83-84.

some decision-making input, all final determinations were vested in the federal government.[68]

Newfoundland continued to claim exclusive jurisdiction; but when its case was heard by the Supreme Court of Canada in 1984 the Court ruled that, at least in the Hibernia area, Canada and not the province had the right to explore and exploit natural minerals and resources on the continental shelf.[69] In 1987, Newfoundland finally entered into an accord with the federal government for revenue sharing and resource management schemes.[70] This accord differed substantially from the Canada-Nova Scotia Agreement because Newfoundland maintained veto power over certain regulations and amendments had to be mutually agreed upon. Furthermore, the federal government agreed that the Accord would take precedence over any other inconsistent Act of Parliament that applied to the offshore.[71] However, the Accord cannot be used as a basis for any claim of legislative jurisdiction over any offshore area or the resources therein.[72]

The Management Boards set up under the Accords are responsible for administering oil and gas rights. In the area near the 1964 line there was some disagreement and uncertainty, due in part to the definition of co-ordinates and precise location of the line. In addition the settlement of the Canada-France boundary around St. Pierre and Miquelon Islands gave France a narrow passage, which included rights to the resources of the continental shelf. By 1998-99 some exploration companies seemed to prefer investment in the French channel and thus the uncertainties in the Nova Scotia-Newfoundland line became a pressing public issue. Thus the Provinces and Federal Government agreed to submit the location of the revenue-sharing line to the independent tribunal.

4.3 The Decisions and Reasoning of the Tribunal

The major issue before the Tribunal was the question of what line should represent the boundary for sharing offshore oil and gas revenues

---

[68] Gault [1985], p. 83.
[69] *Re: Newfoundland Continental Shelf.* (1984), 1 S.C.R. 86.
[70] *Canada-Newfoundland Atlantic Accord Implementation Act* (1987, c. 3). Consolidated Statutes and Regulations. Retrieved from: http://laws.justice.gc.ca/en/C-7.5/21662.html August 2001.
[71] *Canada-Newfoundland Atlantic Accord Implementation Act* (1987, c. 3). s. 4. Consolidated Statutes and Regulations. Retrieved from: http://laws.justice.gc.ca/en/C-7.5/21662.html August 2001.
[72] *Canada-Newfoundland Atlantic Accord Implementation Act* (1987, c. 3). s. 3. Consolidated Statutes and Regulations. Retrieved from: http://laws.justice.gc.ca/en/C-7.5/21662.html August 2001.

between the two provinces. In essence this is an administrative line and is not necessarily a jurisdictional boundary.

The arbitration consisted of two stages. The first considered the legal status of the 1964 agreement and therefore the line generated by the parties under that agreement. If the agreement was considered binding by the Tribunal, then there would be no need for a second stage to delimit the shared boundary.

4.2.1 Stage 1 Results and Reasoning

In the first part of the arbitration, the Tribunal held that no boundary had been resolved between Nova Scotia and Newfoundland and Labrador despite the existence of the 1964 map and document. (See also section 2.2, above.) Again, their reasoning stemmed from the fact that on October 6, 1972, Newfoundland sought clarification from Nova Scotia *"of the 'present demarcation' vis-à-vis Nova Scotia…,"*[73] and attached a copy of the 1964 map with an alternative boundary dashed in. They held that Nova Scotia was from this point *"put on notice that there was no agreement between the two provinces on the location of the southeasterly line."*[74]

4.2.2 Stage 2 Results and Reasoning

4.2.2.1 Newfoundland's Conduct

In the second part of the arbitration, the Tribunal's task was to arrive at and delimit the Nova Scotia-Newfoundland shared boundary. Nova Scotia continued to argue that sustained conduct on the part of Newfoundland made the 1964 agreement binding. However, the Tribunal further held that *"there was no 'sufficiently clear, sustained and consistent' conduct on the part of Newfoundland and Labrador to justify holding that it accepted the line in the inner sector."*[75] Also, as to the outer area (i.e., the area surrounding the Laurentian Sub-Basin), the Tribunal held that Newfoundland's practice in relation to the 1964 line in this area *"does not sustain a claim of acquiescence, or support the view that the Parties regarded that line as equitable."*[76]

---

[73] *Arbitration Between Newfoundland and Labrador and Nova Scotia.* March 26, 2002. P. 7.
[74] *Arbitration Between Newfoundland and Labrador and Nova Scotia.* March 26, 2002. P. 7.
[75] *Arbitration Between Newfoundland and Labrador and Nova Scotia.* March 26, 2002. P. 24.
[76] *Arbitration Between Newfoundland and Labrador and Nova Scotia.* March 26, 2002. P. 25.

4.2.2.2 The Geneva Convention

The Tribunal held that the terms of the *Geneva Convention on the Continental Shelf* on boundary delineation applied to the case, despite the fact that Nova Scotia and Newfoundland and Labrador were not sovereign entities. Pursuant to the terms of both of the Accords, as well as the Terms of Reference to be used by the Tribunal, the Tribunal applied *"the principles of international law governing maritime boundary delimitation with such modification as the circumstances require… as if the parties were states subject to the same rights and obligations as the Government of Canada at all relevant times…"*[77] The Tribunal ruled that *"As a party to the 1958 Geneva Convention without any reservation, Canada is subject to the rights and obligation it incorporates… So, too, under the Terms of Reference, are Nova Scotia and Newfoundland and Labrador."*[78]

The Tribunal reached this conclusion in spite of Nova Scotia's arguments that a) the "'offshore areas' to be delimited by the Tribunal differ significantly from the continental shelf in legal terms," b) "particularly in terms of their basis of title…" which in the case of this dispute "derives from a 'negotiated entitlement…'" and c) that the scope of "interests in the two types of zones is different," as the continental shelf regime, unlike the case at bar, includes interests in sedentary species and mineral resources other than hydrocarbons.[79] The Tribunal pointed out that it "hardly seems possible to speak of a domestic basis of title in this case when domestic law grants the parties no title or ownership whatever over offshore areas or resources."[80]

Overall, the Tribunal ruled that the applicable law in this case was "the principles of international law… includ[ing] the provisions of Article 6 of the 1958 *Geneva Convention* and the developments under customary international law that have been associated with the interpretation and application of Article 6."[81] As to the Terms of Reference clause "'with such modifications as the circumstances require,'" the Tribunal held that this did not mean modifying the principles of international law apart from making sure they were

---

[77] *Arbitration Between Newfoundland and Labrador and Nova Scotia.* March 26, 2002. P. 13.
[78] *Arbitration Between Newfoundland and Labrador and Nova Scotia.* March 26, 2002. P. 18.
[79] *Arbitration Between Newfoundland and Labrador and Nova Scotia.* March 26, 2002. P. 13-14.
[80] *Arbitration Between Newfoundland and Labrador and Nova Scotia.* March 26, 2002. P. 15
[81] *Arbitration Between Newfoundland and Labrador and Nova Scotia.* March 26, 2002. P. 21

applicable to the present case, which had already been achieved by the Terms of Reference.[82]

4.2.2.3 Relative Wealth Considerations

In the final delimitation of the boundary, the Tribunal noted that it is now well settled courts engaging in maritime delimitation may not take relative wealth or natural resources of the states involved into account. However, it held that access to the specific resources in question was one relevant factor in the delimitation process. In short, it held that *"it is not the Tribunal's function to share out equitably any offshore resource, actual or hypothetical, irrespective of its location. On the other hand, the effect of a proposed line on the allocation of resources is, in the Tribunal's view, a matter it can properly take into account among other factors."*[83]

4.2.2.4 Geographic Considerations

The Tribunal factored many geographic elements into its final delimitation. For example, since it was treating the parties as sovereign states it considered the Gulf of St. Lawrence as though it were an enclosed sea. It identified many relevant coasts, areas, and islands, including Fortune Bay in Newfoundland, the northeastern point of Cape Breton Island, and Scatarie Island. The Tribunal also noted that *"the coasts of Newfoundland and Cape Breton Island are essentially opposite, albeit receding, coasts…."* The Tribunal's distinction between what it termed "inner" and "outer" areas – a distinction which largely *"corresponds to the transition between the area where the Parties' coasts are essentially opposite, and those (in the outer area) where they are, 'rather comparable to adjacent coasts…'"*[84] This geographic distinction has been used in international delimitations such as the US-Canada boundary in the Gulf of Maine to isolate areas (i.e., opposite coasts) where application of pure equidistance principles is more appropriate.

The provinces each arrived at relevant areas for the purposes of applying a type of proportionality test. The legal arguments for these relevant areas differed significantly, with the result that Newfoundland

[82] *Arbitration Between Newfoundland and Labrador and Nova Scotia.* March 26, 2002. P. 21
[83] *Arbitration Between Newfoundland and Labrador and Nova Scotia.* March 26, 2002. P. 26.
[84] *Arbitration Between Newfoundland and Labrador and Nova Scotia.* March 26, 2002. P. 28.

and Labrador's ratio of coastal lengths was more than 2:1 in its favour, whereas the Nova Scotia ratio of coastal lengths was 1:0.94 in Nova Scotia's favour. The Tribunal rejected both arguments and held that it would treat as *"relevant any coast of either party which affects or might potentially affect the delimitation. This involves a practical judgment, not merely a geometrical concept; it needs to have regard to the zone to be delimited and the respective claim lines of the parties."*[85] The Tribunal did not think it appropriate to even apply the proportionality test "of coastal lengths and maritime areas"[86] in this case.

As to offshore Islands, the Tribunal examined the circumstances of islands under debate separately. Only Sable Island will be considered here because of its drastic impact on the outcome of the arbitration. The Tribunal held Sable Island to be part of Nova Scotia for the purposes of the delimitation despite the fact that *"exclusive federal ownership and jurisdiction…[was] established by the Constitution Act, 1867."*[87] The Tribunal originally gave Sable Island half effect on the location of the equidistance line, as it considered full effect to have disproportionate results, especially given that Sable Island is uninhabited and small.[88]

4.2.2.5 Final Delimitation and the Final Effect of Sable Island

The Tribunal began the actual delimitation process by "the construction of a provisional equidistance line…"[89] and went on to determine "whether it requires adjustment in the light of special circumstances."[90] The Tribunal constructed this provisional equidistance line in three stages, so as to allow it to "take account of the relevant circumstances in each area…"[91] The Tribunal began its first provisional boundary segment "at the closing line at the entrance to the Gulf of St. Lawrence"[92] and this line goes through a number of gradual turns until it "intersects with the Scatarie Island-Lamaline Shag Rock closing line, 11.8 nautical miles west of the mid-point of that line."[93] The Tribunal

[85] *Arbitration Between Newfoundland and Labrador and Nova Scotia.* March 26, 2002. P. 30.
[86] *Arbitration Between Newfoundland and Labrador and Nova Scotia.* March 26, 2002. P. 31.
[87] *Arbitration Between Newfoundland and Labrador and Nova Scotia.* March 26, 2002. P. 33.
[88] The effect of Sable Island undergoes further development during the Tribunal's decision. See section 3.2.5.
[89] *Arbitration Between Newfoundland and Labrador and Nova Scotia.* March 26, 2002. P. 34
[90] *Arbitration Between Newfoundland and Labrador and Nova Scotia.* March 26, 2002. P. 34
[91] *Arbitration Between Newfoundland and Labrador and Nova Scotia.* March 26, 2002. P. 34.
[92] *Arbitration Between Newfoundland and Labrador and Nova Scotia.* March 26, 2002. P. 35
[93] *Arbitration Between Newfoundland and Labrador and Nova Scotia.* March 26, 2002. P. 35

then examined this line in light of the Parties' conduct. It determined that since

> the dividing line conditionally drawn in the inner area in 1964… was essentially a simplified median line [and since]…Newfoundland never raised any objection to or difficulty with that line up to turning point 2017… [and] to a lesser extent for reasons of administrative convenience… it would be both equitable and appropriate to simplify this strict equidistance line by drawing a straight line between turning points 2016 and 2017. [94]

The second boundary segment was drawn from the end point of segment 1 through several turns "until it comes under the control of Cape Pine on the coast of Newfoundland, where it partially resumes its southeasterly course."[95] As to this segment of the boundary, the Tribunal agreed with Newfoundland and Labrador that "beyond the Scatarie-Lamaline Shag Rock closing line, this case is to be decided exclusively on grounds of the relevant coastal geography,"[96] as the conduct of the parties did not justify any departure from the provisional line in this area. The Tribunal modified the equidistance line for the specific geography including the half effect to be given to Sable Island. Then it examined whether the adjusted line produced an inequitable result between the parties, and whether this line produced a cut-off effect on the southwest coast of Newfoundland. In the final analysis, the Tribunal concluded that the effect of Sable Island should be further reduced to decrease this cut-off effect, and held that, in the end, Sable Island was to have no effect on the equidistant line at all.[97]

As to the last boundary segment, from Cabot Strait northwestward in the Gulf of St. Lawrence, the Tribunal decided as follows:

> Northwestward of turning point 2016, a strict equidistance line between the adjacent coasts here concerned would terminate at a tripoint with Quebec slightly to the north of turning point 2015. The difference between the two lines and the areas they divide is not significant, and the Tribunal, having regard to the conduct of the Parties in this sector, considers it appropriate to delimit this small,

---

[94] *Arbitration Between Newfoundland and Labrador and Nova Scotia.* March 26, 2002. P. 35.
[95] *Arbitration Between Newfoundland and Labrador and Nova Scotia.* March 26, 2002. P. 36
[96] *Arbitration Between Newfoundland and Labrador and Nova Scotia.* March 26, 2002. P. 36
[97] *Arbitration Between Newfoundland and Labrador and Nova Scotia.* March 26, 2002. P. 37.

> innermost area by a straight line joining turning points 2016 and 2015. The Tribunal emphasizes that its decision on this matter, as indeed the whole of its decision, is binding only on the Parties to this case and cannot prejudice the rights of any other parties that may be concerned.[98]

4.4 Conclusions & Points of Interest for the Surveyor

From a surveying perspective the boundary delimitation issues in the Nova Scotia/Newfoundland arbitration included, but were not limited to,

a. equidistance principles
b. access to resources
c. adjacent and opposite coasts
d. proportionality of respective coastline length to the area claimed
e. the status and weight given to offshore islands, including Sable Island.

This is the first time that a maritime inter-provincial boundary in Canada has been delimited by an arbitration panel. The question that naturally arises is whether this decision will have an effect on future inter-provincial boundary disputes.

Considering that Canada is largely a Common Law jurisdiction and that common law courts like to follow precedent, it would be difficult to imagine that the decision of the Tribunal would be ignored in future disputes. However, its effect on their outcome is uncertain. Much would depend on the specific circumstances of the case, the particular terms of reference given to the panel in the case of an arbitration, and developments in marine boundary law.

For one thing, offshore boundaries may be related to federal and provincial administration over specific activities or specific resources, or they may delimit sovereignty, ownership, or jurisdiction. The Nova Scotia-Newfoundland arbitration, for example, seems to have created a line for revenue sharing and administration of hydrocarbon rights. It certainly did not affect ownership of the bed, and it said nothing about the fisheries, environmental regulations in general, or, for that matter, the extent of Canada Lands. All of these issues are still a matter for the courts or negotiation and will most likely only be resolved on a case-by-case basis.

[98] *Arbitration Between Newfoundland and Labrador and Nova Scotia.* March 26, 2002. P. 37.

> Other inter-provincial marine administrative boundaries in Atlantic Canada may be based on some of the principles of the Newfoundland-Nova Scotia arbitration but each will also depend on unique historical, geographical, legal, and other issues. In the Bay of Fundy, for example, there may be myriad administrative boundaries. Jurisdictional and ownership boundaries may depend on whether the bay is an historical bay, whether the centerline definition of Nova Scotia and New Brunswick territory in the 1700s[99] established jurisdiction or ownership, and whether the 1964 "agreement" has any force between these two provinces.
>
> In short, the extent to which the Nova Scotia/Newfoundland Arbitration will affect any future marine boundaries in the Atlantic Provinces is difficult to ascertain. The review of the delimitation given here is based primarily on the decision of the Tribunal that was announced on April 1, 2001, and not on the detailed transcripts of proceedings. The transcripts will, no doubt, shed further light on the arguments used by the provinces and on the Tribunal's reasoning. More extensive analysis, conclusions and descriptions are sure to come to light as scholars examine these details.

End of Extract

4.5 The Newfoundland & Labrador – Nova Scotia Arbitration's Effect on the Hypothesized Legal Framework

4.4.1 The Arbitration and Administration and Governance of Property Interests

In this case, the property interests in question are narrow in scope. The only resources in question here are hydrocarbon resources offshore, and the only property interests the provinces have in these resources are the rights to revenue-sharing and shared lease administration. [Arbitration, 2002, P. 15]. However, as we have seen, the decision of this tribunal will certainly have an effect on the territory over which each

province will administer its rights. In other words, this tribunal determined and set out who administers marine resources over what spatial extent.

However, it is also clear that past actions, such as Newfoundland requesting clarification of the boundary, had an effect on the tribunal's decision. This type of request can be seen as an administrative or governance act. This is in keeping with the arrows indicated after the conclusion of the UNCLOS Article 76 case study, in that while the decision influences administration and governance, past governance or administrative acts influenced the decision as well. Therefore, it is not necessary for the particular marine question to have a centuries-long legal history in order for that section of the framework to apply.

4.4.2 The Arbitration and Technological and Methodological Use

Similarly to the UNCLOS case study, it is clear in the case of the arbitration that past methodology and technological use influenced the decision-makers. In particular, the geographic considerations, including proportionality, the effect of islands, equidistance principles, and the consideration of adjacent and opposite coasts are geomatics methodologies used the world over for determination of marine boundaries.

What is perhaps less clear, however, is the way in which this arbitration will influence technological or methodological use. The tribunal has no stated hierarchy of evidence, and does not clearly state a preference in their decision for the use of particular methodology at all times. This is because much in the legal sphere depends

---

[99] Mentioned in a Report on the Rights of the Provinces of Nova Scotia, New Brunswick, and Prince Edward Island to the Ownership of Adjacent Submarine Resources. Submitted to the Government of

on the facts of a particular case. However, since the tribunal was operating in a common law theatre (Canada), the precedent this case will set for similar cases may influence the choice of arguments for future parties to marine boundary disputes. For example, having observed that Sable Island was given zero effect in the final boundary, a province is put on notice that where a cut-off effect may occur, it should argue that no effect be given to a particular island in the opposing party's territory.

While this, as pointed out, is not the only case to use these methodologies, it is a case that adheres largely to world-wide precedent, and most particularly cases of the International Court of Justice. [*Gulf of Maine, Libya/Malta, Jan Mayen* to name a few]. This means three things. First, it adds its weight to the body of precedent in the marine boundary arena by applying internationally recognized methodologies. In theory, this should bolster the continued use of these methodologies. Second, it puts Canadian provinces on notice of the types of methodologies they should probably use to argue an inter-provincial boundary dispute. Third, given the principal of *stare decisis* in common law jurisdictions, it suggests the outcome of future cases with similar facts. Take, for example, the application of no effect to Sable Island. This arbitration's decisions about Sable Island give a basis for future parties to argue that similarly situated islands should (a) be given weight even when they are federally owned and under federal jurisdiction, and (b) have no effect in the final analysis if they produce too much cut-off effect for the opposing party. As such, the tribunal's decision may indeed affect future methodological use.

New Brunswick September 1959.

4.4.3 The Arbitration and Information Management

The first and most obvious way in which the tribunal influenced information management is that its outcome determined the province of registry for the oil and gas leases in the region. In other words, the boundary delimited by the tribunal is the boundary between Newfoundland's oil and gas leases and Nova Scotia's oil and gas leases.

The question arises here as to whether information management, per se, influenced the outcome of the arbitration. Newfoundland's letter asking for clarification of the boundary may possibly be seen as information management. If so, this supports the new arrow added to the framework after the UNCLOS study, which indicates that information management may have some influence on the law. As such, the framework for the Newfoundland – Nova Scotia case study is shown in Figure 4.1, and the overall framework is consistent and remains as shown in Figure 4.2, below.

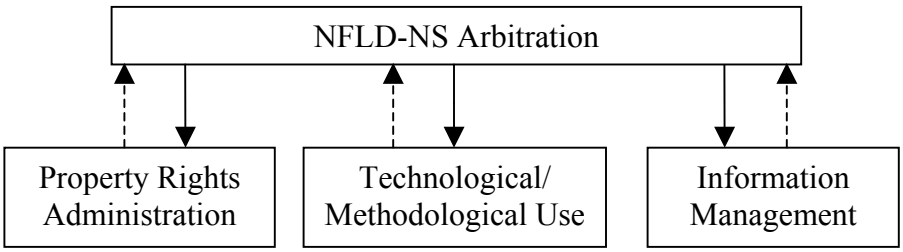


Figure 4.1: The Framework for the Newfoundland – Nova Scotia Case Study

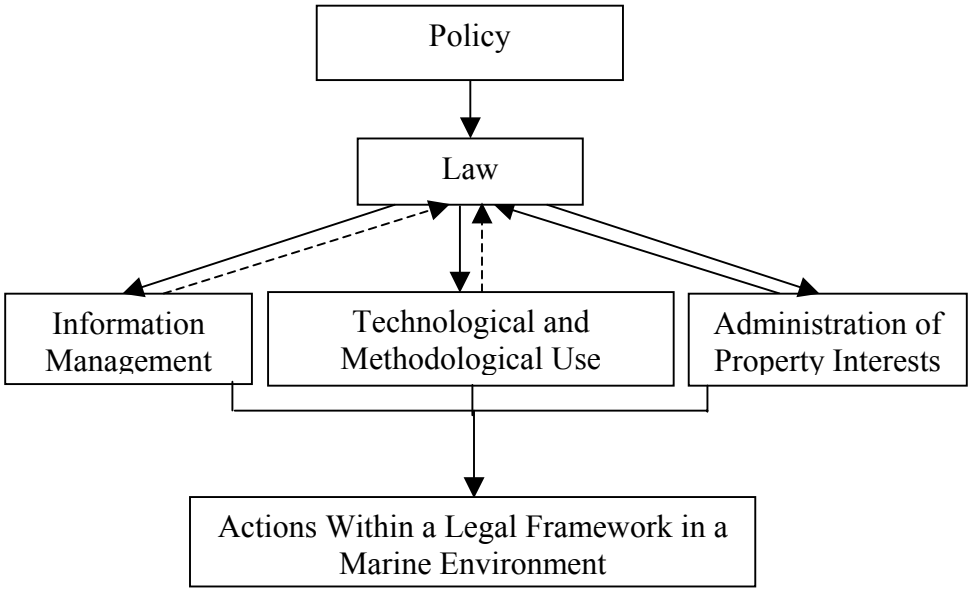


Figure 4.2: The Framework after the Newfoundland – Nova Scotia Arbitration Case Study

Perhaps the most interesting thing about this case study is that it begins to show that the framework will apply in different legal settings. It is clearly not limited to the UNCLOS (international law) application, and here has an application that inter-provincial in nature. It remains to be seen whether all or part of the framework can be applied to a more local marine boundary development.

CHAPTER 4 REFERENCES

Arbitration Between Newfoundland and Labrador and Nova Scotia Concerning Portions of the Limits of Their Offshore Areas as Defined in the Canada-Nova Scotia Offshore Petroleum Resources Accord Implementation Act and the Canada-Newfoundland Atlantic Accord Implementation Act: Award of the Tribunal in the Second Phase. Ottawa, March 26, 2002. P. 6. Retrieved from: http://www.boundary-dispute.ca, April 2002.

Black's Law Dictionary, Fifth Edition, by Henry Campbell Black (5th Ed. By the Publisher's Editorial Staff), West Publishing Co., St. Paul, Minn. 1979.

Canada-Newfoundland Atlantic Accord Implementation Act (1987, c. 3). s. 3. Consolidated Statutes and Regulations. Retrieved from: http://laws.justice.gc.ca/en/C-7.5/21662.html August 2001.

Canada-Nova Scotia Agreement on Joint Management and Revenue Sharing [1988, c. 28]. Consolidated Statutes and Regulations. Retrieved from: http://laws.justice.gc.ca/en/C-7.5/21662.html August 2001.

Cockburn, S. and S. Nichols (2002a). "Effects of the Law on the Marine Cadastre: Title, Administration, Jurisdiction, and Canada's Outer Limit." *Proceedings of the FIG Congress*, Washington DC, USA, April 24, 2002.

Cockburn, S. and S. Nichols (2002b). "Factors in Inter-provincial Boundary Delimitation: Points of Interest for Surveyors in the Newfoundland & Labrador/Nova Scotia Boundary Arbitration." Contract report for Service New Brunswick, Fredericton, New Brunswick, November 2002.

International Court of Justice. (1981-1984). Delimitation of the Maritime Boundary in the Gulf of Maine Area (Canada/United States of America). Retrieved from the World Wide Web May, 2004. http://www.icj-cij.org/icjwww/icases/icigm/icigmframe.htm

International Court of Justice. (1988-1993). Maritime Delimitation in the Area Between Greenland and Jan Mayen (Denmark v. Norway). Retrieved from the World Wide Web May, 2004. http://www.icj-cij.org/icjwww/icases/igjm/igjmframe.htm

International Court of Justice. (1982-1985). Continental Shelf (Libyan Arab Jamahiriya/Malta. Retrieved from the World Wide Web May, 2004. http://www.icj-cij.org/icjwww/icases/ilm/ilmframe.htm

Gault, I. T., “Jurisdiction Over The Petroleum Resources of the Canadian Continental Shelf: The Emerging Picture.” *Alberta Law Review*, Vol. XXIII, No. 1. [1985], p. 82.

Nichols, S., I. Edwards, J. Dobbin, K. Komjathy, and S. Hanham [1997]. "Real Property Issues in the Marine Aquaculture Industry in New Brunswick." Contract Report for the Department of Fisheries and Aquaculture, Fredericton; NB.

Nichols, S., J. Dobbin, S Ng’ang’a, S. Cockburn, M. Sutherland, K. Cove, and T. Beran [2001]. "Roles and Responsibilities for Surveying in Offshore Canada Lands." Contract report for the Legal Surveys Division, Natural Resources Canada, Oct. 1.

Re: Newfoundland Continental Shelf. (1984), 1 S.C.R. 86.

Sutherland M (2002). *A Philosophy of Marine Boundaries Facilitating Ocean Governance.* Ph.D. thesis in progress, Department of Geodesy and Geomatics Engineering, University of New Brunswick, Fredericton, Canada.

Sutherland, M., S. Ng'ang'a and S. Nichols (2002). "In Search of New Brunswick's Marine Administrative Boundaries." Accepted for *Proceedings of the CIG-ISPRS Joint Symposium on Geospatial Theory, Processing and Application*, Ottawa, July 2002.

Sutherland, M. and S. Nichols [2002]. "Design of a Marine Boundary Database Architecture for the Bay of Fundy." Contract Report for the Canadian Hydrographic Service, Ottawa, March, 2002.

5: CASE STUDY IV: NEW BRUNSWICK'S COASTAL AREAS PROTECTION POLICY

5.1 The Selection of the Coastal Areas Protection Policy Case Study[100]

This case-study had several things to recommend it. First, it is a very new policy which has made its way to the legislature but has not yet become law at the time of writing of this thesis. As such, it embodies the most modern approach in New Brunswick on marine management. Second, it is specific to New Brunswick. Third, it is a different source of law than either of the aforementioned case studies, being a provincial policy, as opposed to inter-provincial arbitration or international law. Fourth, it is a policy that affects coastal zone land boundaries, as opposed to simply boundaries in water. As such, the boundaries it affects would have to be included in a comprehensive marine cadastre. The question is whether the framework will need to be altered to accommodate laws applicable to this type of marine boundary.

5.2 Coastal Lands Protection: A Historical Perspective

5.2.1 Coastal Water Law, Generally

5.2.1.1 Private vs. Crown Ownership Along the Coast: Ambulatory Boundaries

Naturally, when examining the laws affecting coastal properties, the paramount question is "Who owns what?" The *prima facie* [Black, 1979][101] rule is that "a grant of

[100] The New Brunswick Coastal Areas Protection Policy was, at time of writing, as described herein. However, it has since been sent to government and may undergo further changes as it works its way through the system.

land bounding the sea carries title down to high water mark.[102] Unless expressly granted, the shore, i.e. the land between high and low water mark, remains in the Crown." [LaForest, 1973, p. 463]. High and low water marks, however, are not fixed – they change over time and with the season. "A natural water boundary is ambulatory; its location moves as a result of gradual, physical changes in the shore such as erosion. Any delimitation of the boundary is therefore only an indication of its position at some particular time." [Nichols, 1989, P. 170].

The ambulatory boundary doctrine makes it seem as if a water boundary is no boundary at all. How, then, do we define such a boundary? "…[B]oundaries are often referenced to a specific water level. Defining this level and finding evidence of where it intersects the shore are the major problems in the delimitation of water boundaries along the coast." [Nichols, 1989, P. 170]. More specifically, a "…tidal boundary is located by evidence of the intersection of the water with the shore when the water reaches a specific level of tide." [Nichols, 1989, P. 170]. These tidal heights are measured in relation to a surface called Chart Datum,[103] and measurements usually need

---

[101] *Prima facie* is a legal term meaning: "…a fact presumed to be true unless disproved by some evidence to the contrary." *Black's Law Dictionary, 5th Edition*. By Henry Campbell Black, M.A. (5th Edition by The Publisher's Editorial Staff – Contributing Authors Joseph R. Nolan and M.J. Connolly), West Publishing Company, St. Paul Minnesota, 1979.

[102] Nichols, S. *Water Boundaries – Coastal*. In: Survey Law in Canada further defines high water mark as the "ordinary high water mark."

[103] Chart Datum is defined by The Canadian Hydrographic Service (Canadian Hydrographic Service (2000). *Vertical Datums and Water Levels*. Retrieved from the World Wide Web December 21, 2000. http://biachss.bur.dfo.ca/danp/datums.html) as follows: "For navigational safety, depths on a chart are shown from a low-water surface or a low-water datum called chart datum. Chart datum is selected so that the water level will seldom fall below it and only rarely will there be less depth available than what is portrayed on the chart." Canadian Chart Datum is "…the Lower Low Water, Large Tides (LLWLT), defined as 'the average of the lowest low waters, one from each of 19 years of predictions.'" Nichols, S. *Chapter 5: Water Boundaries – Coastal*. In: Survey Law in Canada, p. 178.

to be converted to "geodetic elevations[104] for cadastral surveys." [Nichols, 1989, P. 180]. However, as tidal elevations change, the Chart Datum occasionally needs to be updated.

> Long term trends in regional and global sea level, as well as land subsidence and uplift, can also cause water level elevations to change over time with respect to the geodetic datum. In Canada, chart datum is updated occasionally to reflect these trends or to take new observations into account. Chart Datum in Halifax, for example, has recently been raised by approximately 0.29 meters. [Nichols, 1989, P. 181-182].

This change in Chart Datum can alter where the "ordinary high water mark" is considered to be along your property, and hence can change your property boundary. In fact, it seems that this is what will happen should, for example, sea level rise due to climate change. Property boundaries would slowly be redefined along with the ordinary high water mark, and this, coupled with the doctrine of erosion (see below) would cause large portions of newly submerged lands to revert to the Crown.[105]

The exception to the ambulatory boundary rule occurs when a property line is fixed. "Specifically described lands… continue their former boundaries whether the adjoining water rises or recedes." [LaForest, 1973, P. 231]. In other words, if a property is defined by metes and bounds, for example, and not by "the shore," the

---

[104] "Sea Level, or mean sea level, the average height, or elevation, of the sea surface as determined from periodic measurements made for at least 19 years. Scientists measure sea level over a long period of time to eliminate temporary changes in water level due to tides, waves, wind, and air pressure.

Geographers use sea level as the starting level for measuring the height, or elevation, of the earth's surface. However, over long periods of time and great distances, the level of the sea changes. In the 1920s geographers used tide gauges set up in the United States and Canada to establish a permanent measure of mean sea level, called the Sea Level Datum of 1929, renamed in 1973 to the National Geodetic Vertical Datum. The National Geodetic Vertical Datum is a horizontal plane in space against which ground elevations and water surface elevations are referenced." MSN Encarta Resources for Interactive Learning: Encyclopedia (date unknown). *Sea Level*. Retrieved from the World Wide Web December 21, 2000. http://encarta.msn.com/find/Concise.asp?z=1&pg=2&ti=761569928&cid=3#p3

property boundary will remain where it is, regardless of how the water level changes. In short, if a parcel of land is bounded on one or more sides by the ocean, that boundary is ambulatory – it can move as the shoreline changes due to accretion or erosion, or as tide levels change.

5.2.1.2 Private vs. Crown Ownership Along the Coast: Accretion and Erosion

When we examine properties with ambulatory boundaries[106] in the context of the coast, we must also discuss the legal rules[107] regarding accretion and erosion. There are two kinds of accretion. "Accretion is defined as the gradual and imperceptible increase to land bordering water through deposit of alluvium on the banks or shore *or* through withdrawal of the water." [Nichols, 1989, P. 188]. The doctrine of accretion states that the upland owner of a riparian[108] parcel of land is entitled to any new lands so formed. [Nichols, 1989, P. 188]. Therefore, if a parcel of land gained several meters of beach via accretion, (provided the beach was above ordinary high tide) the upland owner would become the owner of the newly accreted portion of beach.

Unfortunately for coastal landowners whose properties have ambulatory boundaries, the opposite is true of erosion. The erosion doctrine is particularly interesting in the context of sea level rise due to climate change. Erosion is defined as

---

[105] A New Brunswick or Canadian lawyer would be required to confirm this. However, were these doctrines operating alone it seems that this is what would occur.
[106] The accretion and erosion rules do not apply to properties with fixed boundaries.
[107] The discussions of legal rules in this paper are discussions of general principals. Delving further into, for example, the apportionment of accretion between adjacent property owners is beyond the scope of this paper. There may also be specific regional legislation or local case law that deals with accretion and erosion, for example, in a region-specific way, which are also beyond this project's scope.
[108] A riparian parcel is defined by Nichols, S. as a parcel "bounded by [the] watercourse and not a fixed line." *Chapter 5: Water Boundaries – Coastal*. In: Survey Law in Canada, p. 188.

the "gradual and imperceptible loss of land due to the natural action of the water…" [Nichols, 1989, P. 188] or "…the encroachment of water upon it…." [LaForest, 1973, P. 226]. The erosion doctrine states that "… title to the submerged lands belongs to the owner of the bed." [Nichols, 1989, P. 188]. This means that once sea level rises to a point where property owners' lands are submerged below the ordinary high water mark, they will lose their lands to the Crown.

5.2.1.3 Private vs. Public Rights Along the Coast: When Can the Public Use My Beach?

What else might go on in a property owner's "back yard" if their property is affected by sea level rise? In Common Law jurisdictions like Canada, the public have certain vested rights to the use and enjoyment of the foreshore and navigable waters. First, there is the right of navigation. This right exists only in navigable waters,[109] which tidal waters are prima facie considered to be, and is a paramount right, which will prevail over the rights of the owner of the bed, and also over the rights of the upland owner. [Nichols, 1989, P. 189]. The other main right is the right of fishing. The public is entitled to fish "…in all tidal waters… up to the point where the tide ebbs and flows." [LaForest, 1973, P. 226]. The public right of fishing in tidal waters "…includes the right to harvest clams and other shellfish on the foreshore, whether this is Crown or

[109] "Navigable waters" is a specific legal term with varying definitions depending on the jurisdiction. In short, tidal waters carry a prima facie presumption that they are navigable. This presumption may be rebutted, but whatever test is used the waters must also be navigable in fact. (La Forest, G.V. and Associates. *Water Law in Canada: The Atlantic Provinces*. Regional Economic Expansion (1973), p. 180.) Navigability in fact (or de facto navigability, i.e., whether the waters are actually capable of supporting navigation) is a question of fact for a court of competent jurisdiction. This determination hinges on various factors which are, again, jurisdiction-dependent. Some courts will find a waterbody navigable merely because it supports the transport of tourists in small craft.

private land." [LaForest, 1973, P. 226]. Therefore, if sea level begins to encroach on an upland owner's property, the public may encroach there too.

5.2.1.4 Private Rights Along the Coast: How Can Upland Owners Protect Themselves?

Do the general doctrines of coastal law afford the upland owner any protection from encroaching sea level? One possibility lies in the erosion doctrine. "The owner of land on a body of water has a right to have the natural barriers against encroachment on his land maintained." [LaForest, 1973, P. 231]. They may therefore collect damages should anyone try to remove these natural barriers in any way, be it intentional or not. [LaForest, 1973, P. 231]. Furthermore, the "…owner of land adjacent to water, whether on the sea or on inland streams or lakes, may take steps to protect his property from being washed away or invaded by water." [LaForest, 1973, P. 232]. However, they may not divert the water to an area further away than its original channel. [LaForest, 1973, P. 232]. A riparian owner is even entitled to build a bulwark or dyke to protect his/her property, but may not do so in such a way as to "…injure his neighbor and [must] do no more than is necessary to protect himself." [LaForest, 1973, P. 232]. In some areas, however, it would seem that such construction would afford little protection from sea level rise, should it reach predicted levels.[110]

This right to protect one's land from erosion[111] may serve to protect coastal properties, but we should probably have a better contingency plan in place. The more

[110] Please see discussion above.
[111] The Crown may also have a right to prevent flooding or to build dykes, but that discussion and the takings law principles that would accompany it are beyond this paper's scope.

specific thrust of this chapter is to examine whether there are any provisions in New Brunswick's Proposed Coastal Zone Policy which might fulfill this need, and a discussion of whether it will afford coastal land owners any protection from sea level rise.

5.3 The Elements of the Coastal Zone Policy as it Exists Today

5.3.1 Zone A: Coastal Lands Core Area

The Coastal Areas Protection Policy for New Brunswick (hereinafter the CAPPNB, the policy, or the Coastal Policy) defines "coastal lands core area" as including "…beaches, dunes, rock platforms, coastal marshes and dyked lands found between the Higher High Water Large Tide (HHWLT) and the Lower Low Water Large Tide (LLWLT) plus dunes extending beyond the HHWLT…." [CAPPNB, 2002, P. 8]. Unlike the Provincial Land Use Policy proposal for New Brunswick's Coastal Lands of 2000, these terms are not defined specifically in the policy.[112] The policy aims to protect these features, and points out that "Due to the extreme sensitivity and the very high risk of danger/damage from storm surges, fewer development activities would be acceptable in Zone A." [CAPPNB, 2002, P. 8]. The "acceptable activities" for Zone A are mainly non-construction exemptions (one specified intent is to "…minimize structures that would be damaged by flooding during storm surges."). [CAPPNB, 2002,

[112] Department of Environment and Local Government (2000). *Provincial Land Use Policy for New Brunswick's Coastal Lands: A Proposal*. p. 27. Definitions: "'beaches' and 'rock platforms'… may be comprised of unconsolidated deposits of sand, gravel, cobbles or boulders and/or exposed bedrock, and largely devoid of vegetation; 'coastal marshes' being any marsh that drains directly into coastal waters or

P. 9]. These include maintenance of a coastal feature such as planting of native dune grass, development for access and interpretation for educational purposes, traditional agricultural activities on coastal marshes historically dyked for that purpose, etc. [CAPPNB, 2002, P. 9].

5.3.2 Zone B: Coastal Lands Buffer Area

The buffer area is perhaps the most interesting of the four CAPP elements. It is defined as "…the land immediately adjacent to the coastal features. Zone B would consist of area 30 metres landward from the inland edge of Zone A." [CAPPNB, 2002, P. 27]. A slightly greater number of activities are deemed acceptable in this zone, with the exception of Zone B lands adjacent to a coastal marsh. In that case, only acceptable activities for the marsh itself would be acceptable in the adjacent Zone B lands [CAPPNB, 2002, P. 9]. This is because the Coastal Policy considers Zone B lands adjacent to a coastal marsh to be an integral component of the marsh itself [CAPPNB, 2002, P. 9]. Generally, Zone B's acceptable activities include all of Zone A's acceptable activities, plus some others. Single family residences may be constructed in this zone if they (a) are no closer than 10m to coastal lands, (b) water and sewer services are at a "…location furthest from the Coastal Lands area…" [CAPPNB, 2002, P. 10], (c) they are built 2m above HHWLT elevation, and (d) "…[t]here are existing structures within 75m of both sides of the vacant lot." [CAPPNB, 2002, P. 10]. As

---

has the potential to be inundated by salt water, and; 'dunes' which are wind blown deposits of sand that are generally in the form of mounds or hills with or without vegetation or trees."

concerns vacant lots, building "…may be allowed within 30m if the setback cannot be met due to lot configuration, size, access or topography." [CAPPNB, 2002, P. 10].

The following may be allowed, pending review and exemption: Buildings may be expanded up to 40 percent of the original size. Buildings destroyed by natural disaster or fire may be rebuilt on the same location and they may be enlarged by up to 40 percent. However, as concerns repair, expansion or replacement of existing structures, these activities may not be closer to Zone A than the existing structure [CAPPNB, 2002, P. 10]. Also, "[i]n the case of new or rebuilt structures, the habitable portion of the structure [must be] at least 2 metres above the HHWLT… elevation." [CAPPNB, 2002, P. 10]. Other rules also apply to Zone B. For instance, hotels, apartments, and multi-family residences "…will not be considered for this Zone." [CAPPNB, 2002, P. 10]. "Commercial and industrial developments are subject to the same restrictions as in Zone A: they must be coastal location essential, and are subject to assessment." [CAPPNB, 2002, P. 10]. The policy does contemplate that certain activities may require operation within Zone B. These may include transportation concerns and commercial fishing [CAPPNB, 2002, P. 10]. It allows that these types of activities as well as "…infrastructure or development deemed to be in the public interest would be considered for exemption under the policy, providing appropriate analysis had been undertaken." [CAPPNB, 2002, P. 10].

The ambulatory nature of the coastal features, as well as the HHWLT boundary contemplated by the CAPPNB could conceivably create more work for surveyors. Specific policies in regulatory form have not yet addressed the uncertainty of landward

property rights as the coastal features shift. Furthermore, it may be impossible to dismantle or discontinue the development that will have already taken place in the coastal lands area. This may mean that what was intended as a 30-meter buffer zone could become nonexistent in the next century.

Zone B of the CAPPNB allows several potential exemptions for building within the buffer zone. Should the buffer zone erode over time, the properties built within it will be destroyed. For example, the local Development Officer may offer exemptions to build within the 30m Coastal Lands Buffer Area if there are "…existing structures within 75m of both sides of the vacant lot." [CAPPNB, 2002, P. 10]. What's more, a building may "…be allowed within the 30m if the setback cannot be met due to lot configuration, size, access or topography." [CAPPNB, 2002, P. 10]. Also, current structures in the buffer zone may be expanded up to 40%.[CAPPNB, 2002, P. 10].

5.3.3 Zone C: Coastal Transition Area

Another zone proposed by the CAPPNB is the "coastal transition area," which is technically not included in the initial Coastal Areas Protection Plan, but which the CAPP authors claim "…will be adopted in the future…" [CAPPNB, 2002, P. 11]. Also referred to as Zone C, this Zone would extend landward from the outside of Zone B.[113] Due to the varied sensitivities to impact and storm damage in this Zone because of varying "…topography, elevation and the erodability of the land…" [CAPPNB, 2002, P. 11], a precise distance has not yet been established for this Zone. Any activities

potentially taking place in Zone C will be evaluated based on two categories of criteria outlined in the Policy. Basically, the first is "[t]he susceptibility for the development to storm surges," and the second is "[t]he biophysical impact on the coastal ecosystem, of the development." [CAPPNB, 2002, P. 11]. The Policy seems to require that all permanent structures be built 2 metres above HHWLT in this Zone, as well.

5.4 The Erosion Doctrine and the Proposed Coastal Areas Protection Policy

The one area where the policy seems to encourage the protection of real property from the encroachment of the sea is in its unwillingness to interfere with common law doctrine. The policy recommends that "Erosion control works and structures, such as riprap, seawalls, bulkheads…." be permitted without a formal review requirement, although "…some activities may require permits…." [CAPPNB, 2002, P. 15]. Although certain conditions specifying, for example, the height and extent of such structures apply, this section seems to support the use of common law doctrines by private owners in order to protect their property from the rising sea. It does give coastal landowners the opportunity to protect their boundaries from sea level rise due to climate change.

[113] "…from the outside of Zone B…" is the language of the policy – one assumes this means that Zone C

5.5 The Coastal Areas Protection Policy Case Study's Effect on the Hypothesized Legal Framework

5.5.1 The Coastal Areas Protection Policy and Administration and Governance of Property Interests, and Technological and Methodological Use

In the case of the CAPPNB, the property interests in question are broad and varied. Not least of these is the ownership interest in the property, as well as the right to build on the property, and the right to protect the property from erosion. The proposed Coastal Areas Protection Policy will have an effect on each of these rights, and hence on the ways in which these rights are administered and governed. For example, the new permit requirements for certain activities in these zones will require a method for applying for, evaluating and issuing these permits. There will need to be a way to keep track of what permits have been issues to each property owner, and on what grounds.

The new Zoning aspects of the policy, based in part on Higher High Water Large Tide and Lower Low Water Large Tide, "…the Lower Low Water, Large Tides (LLWLT), [being] defined as 'the average of the lowest low waters, one from each of 19 years of predictions.'" [Nichols, 1989, P. 178], will especially influence the methods used by surveyors working in these coastal areas.

> Deciding which datum to use is a beginning: there then must be enough observations, distributed over a long enough time (typically 19 years for LAT), to establish that datum at a gauge. Expanding from the observations at a single point to encompass and properly delineate an entire shoreline requires a different level of effort, and the accuracy with which the low-water line is charted diminishes with increasing distance

---

extends landward from the landward edge of Zone B.

> from the tide gauge, particularly when tide character is significantly changed over that distance. [Monahan, 2001, P. 5-6].

Even surveys of Zone B – the Coastal Lands Buffer Area would have as one bound the HHWLT, or the edge of a dune extending inland from it, and as the other a line 30m inland from these measurements

5.5.2 The CAPPNB and Information Management

The information management considerations inherent in the CAPPNB are tied to a certain extent to its property administration aspects. The new permit requirements under the CAPPNB will require a method for applying for, evaluating and issuing these permits as mentioned *supra*. There will simultaneously be a need to keep track of these permits, and also the surveys used to apply for them. How often these surveys would need to be repeated is not addressed by the Policy, despite the fact that dunes, HHWLT, and other coastal features such as eroding beaches or cliffs may be ambulatory.

5.6 Issues With the Coastal Areas Protection Policy Case Study

While this Case Study does fit the original hypothesis, it differs from the case studies above in several ways that do not lend themselves to the evaluation of the reverse influences from the above case studies. Like the above case studies, boundary-making is one of its goals. However, it is not the Policy's overarching goal, unlike parts of UNCLOS and the Newfoundland – Nova Scotia Arbitration. The Policy's overall goal is to "…manage our land-based coastal resources through sustainable development…." It is likely, therefore, that current technological capabilities did not

have much influence on the policy's development. For example, the measurement of HHWLT is much more complex than the measurement of the High Water Mark (HWM), which can be seen upon the ground as physical evidence. Similarly, current property rights administration schemes and information management issues seem not to have had much bearing on the policy. However, as shown in the previous case studies, the arrows of reverse influence are dashed because these influences may not always exist. As such, while the specific framework for the Coastal Areas Protection Policy for New Brunswick does not have any arrows of reverse influence evident (see Figure 5.1), the overall Legal Framework remains unchanged, as shown in Figure 5.2.

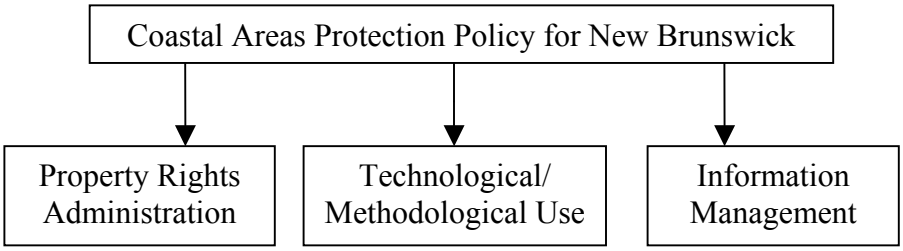


Figure 5.1: The Framework for the Coastal Areas Protection Policy for New Brunswick

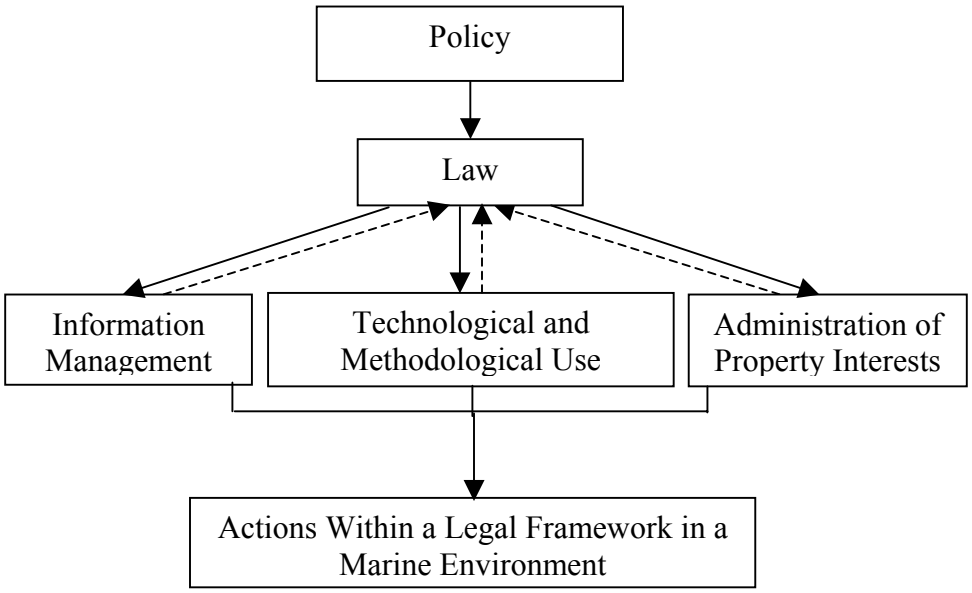


Figure 5.2: The Framework after the Coastal Areas Protection Policy for New Brunswick Case Study

CHAPTER 5 REFERENCES

Black, H.C. (1979). *Black's Law Dictionary, 5th Edition*. (5th Edition by The Publisher's Editorial Staff – Contributing authors J. R. Nolan and M.J. Connolly), West Publishing Company, St. Paul Minnesota.

Department of Environment and Local Government (2000). *Provincial Land Use Policy for New Brunswick's Coastal Lands: A Proposal*.

Department of Environment and Local Government (2002). *A Coastal Areas Protection Policy for New Brunswick.* Retrieved from the World Wide Web May, 2004. http://www.gnb.ca/0009/0371/0002/Coastal-E.pdf

LaForest, G.V. and Associates (1973). *Water Law in Canada: The Atlantic Provinces*. Regional Economic Expansion, Information Canada, Ottawa, 1973.

Monahan, D. and D. E. Wells, 2001a, "Deep Water Challenges to Hydrography Stimulated by the United Nations Convention on Law of the Sea (UNCLOS)," *US Hydrographic Conference*, 21-24 May, Norfolk, VA.

MSN Encarta Resources for Interactive Learning: Encyclopedia (date unknown). *Sea Level*. Retrieved from the World Wide Web December 21, 2000. http://encarta.msn.com/find/Concise.asp?z=1&pg=2&ti=761569928&cid=3#p3

Nichols, S. (1989). "Water Boundaries – Coastal." Chapter 5 in *Survey Law in Canada*, Canadian Institute of Surveying and Mapping, Carswell, Toronto, Canada.

The Canadian Hydrographic Service (2000). *Vertical Datums and Water Levels*. Retrieved from the World Wide Web December 21, 2000. http://biachss.bur.dfo.ca/danp/datums.html

6: CASE STUDY V: UNCLOS' POTENTIAL INFLUENCE ON A MARINE CADASTRE: DEPTH, BREADTH, AND SOVEREIGN RIGHTS

6. 1 Revisiting UNCLOS and the Marine Cadastre

After examining the three main Case Studies, it may prove useful to further examine UNCLOS, as the most comprehensive régime for oceans law ever written, to see if it will influence surveyors beyond the calculation of their nations' outer limits. For these purposes, it will be considered in terms of its potential influence on a multipurpose marine cadastre for two reasons. First, it may be useful to examine such an extensive régime in a more comprehensive way, in a more holistic context, and second, this will couple an established, though relatively new, legal regime with one in its infancy, yet to be defined.

6.2 Cadastres Historically

Extracted from:

Cockburn, S., Monahan, D., and Nichols, S., 2003. "UNCLOS' Potential Influence on a Marine Cadastre: Depth, Breadth, and Sovereign Rights." In *Proceedings of the Advisory Board on the Law of the Sea to the International Hydrographic Organization (ABLOS) Conference "Addressing Difficult Issues in UNCLOS."* Presented at the International Hydrographic Bureau, Monaco, October 2003. http://www.gmat.unsw.edu.au/ablos/ABLOS03Folder/PAPER1-1.PDF

The first draft of the majority of the extracted sections was authored by the author of this thesis. Modifications and additions were carried out by the author of this thesis, Mr. Monahan, and Dr. Nichols.

6.2.1 Land and Marine Cadastre Development

Cadastres have long been established on land to record the boundaries of property and ownership, and indeed the terms "cadastral surveying" and "legal surveying" are often used interchangeably within the geomatics community. The development of the land cadastre that accompanied the European settlement of North America may be a useful analogy for the development the authors see as necessary of a Marine Cadastre. The first mapping by Europeans was exploratory, locating the principal physical features: only later, when the basic topography was mapped could practical mapping of townships, farms, mines and woodlots be undertaken by way of a cadastre. So too in the marine field; most EEZs have had basic exploratory mapping, and preparations for Continental Shelf submissions to the CLCS will have established the principal physical features of the seabed to the Outer Limit of a Coastal State's jurisdiction. Together, the EEZ and the juridical Continental Shelf, where one can be established, constitute a known and finite area within which Coastal States exercise specified jurisdiction or other sovereign rights. Within this area, some Coastal States have already begun to issue exploration licences, which will add to the many existing, and often confusing, boundaries in the marine environment. Participants at a recent FIG workshop believe that this solidifying of offshore zones brought on by UNCLOS means that it is time to construct a Marine Cadastre.[114]

The development of a marine cadastre should be considered by many coastal nations for several reasons:

> A marine cadastre would help clarify jurisdictional complexity in Coastal Zones, would provide the basis for identifying and involving the wide variety of stakeholders involved in co-management of Coastal Zones, would be the basis for managing construction of structures and required easements and rights-of- way, and could help prevent ownership issues from becoming contentious. For many GIS users, the ability to call up a fundamental cadastral layer would permit rapid and appropriate application of their special subject matter within a legally defined zone.[115]

[114] Sutherland, M. 2003. The Outcomes of the UNB-FIG meeting on Marine Cadastre Issues, University of New Brunswick, Fredericton, NB, Canada.
[115] Monahan, D., Nichols, S., and Sherin, A. 2003. *Fundamental contents of coastal GIS- the case for a marine cadastre. In* Coastal GIS 2003. Genoa, Italy, October 16-18, 2003. P. 1

6.2.2 Marine Cadastre Definitions

Definitions of a Marine Cadastre are still tentative and reflect the newness of the subject and the struggle researchers are engaged in. One definition 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."[116] Another description, specific to GIS, defines the marine cadastre as "[a] database that would support a GIS layer that at its display level would show the physical locations of boundaries and limits, and at a deeper level would be supported by information on legal and legislative elements of rights, responsibilities, and restrictions to the areas circumscribed by those boundaries."[117] A third is "…an information system that not only records the interests but also facilitates the visualisation of the effect of a jurisdiction's… laws on the marine environment (e.g. spatial extents and their associated rights, restrictions, responsibilities, and administration)."[118] Clearly, the concepts that are most useful in establishing a marine cadastre vary by jurisdiction, differ significantly from certain land-based cadastral concepts, and are, most of all, still developing and changing.

While seeking to explore how UNCLOS will influence the implementation of a marine cadastre, it is useful to first revisit traditional definitions of a land cadastre in order to determine what is applicable to the marine case and to be able to build upon the existing infrastructure, and also to determine in which ways a Marine Cadastre must, by nature of the environment in which it operates, depart from the land-based model.

---

[116] Williamson, I.P., Leach, J. and Rajabifard, A. (2001) *Marine Cadastres*. Position paper submitted to 7th Meeting of the Permanent Committee on GIS Infrastructure for Asia and the Pacific (PCGIAP), Tsukuba, Japan.
Retrieved from the World Wide Web October, 2003. P. 1
http://www.sli.unimelb.edu.au/maritime/publications/PCGIAP-Cadastral%20WG-Marine%20Cadastre-2001.pdf

[117] Monahan, D., Nichols, S., and Sherin, A. 2003. *Fundamental contents of coastal GIS- the case for a marine cadastre. In* Coastal GIS 2003. Genoa, Italy, October 16-18, 2003. P. 6

[118] Ng'ang'a, S., S. Sutherland, and S. Nichols (2002). *Data Integration and Visualisation Requirements for a Canadian Marine Cadastre: Lessons from the Proposed Musquash Marine Protected Area.* ISPRS Commission IV, Symposium 2002, Ottawa, Canada, July 9-12, 2002. P. 2. Retrieved from the World Wide Web October, 2003.
http://www.isprs.org/commission4/proceedings/pdfpapers/506.pdf

6.3 Global Model of the Land-Based Cadastre

Typically, in the traditional terrestrial-based sense, cadastres have been records of interests in land, the geographic units of which have been ownership parcels. The cadastre has traditionally consisted of two parts – registers and maps.[119] "The Fédération Internationale des Géomètres (FIG) statement on the cadastre has been widely accepted and is now an established principal of land administration systems."[120] The cadastre can currently "… be explained as a parcel based and up to date land information system consisting of a record of interests in land. These interests encompass issues such as rights, restrictions, responsibilities and jurisdictions (FIG, 1995)."[121] Along the same lines in 1975, John McLaughlin defined a cadastre as "a parcel-based record of interests in land encompassing both the nature and extent of these interests."[122]……

When we break McLaughlin's definition of a land cadastre into its elements, we arrive at the following:

1. A Parcel-based record
2. Of interests in land
3. Encompassing the nature and extent of these interests

To begin to define or evaluate a marine cadastre, we assess each of these elements of the land cadastre definition to see whether it is applicable in the marine environment. If not, we must determine why not and whether

---

[119] Williamson, I. (2003). *The Cadastral Concept.* Land Administration 451-418/607 Lecture 4, 2003, PowerPoint Presentation. Retrieved from the World Wide Web October, 2003. http://216.239.41.104/search?q=cache:94F7PlBEYAwJ:www.sli.unimelb.edu.au/subjects/451/418/Lecture%25204%2520-%2520Cadastral%2520Concept%2520-%25202003.ppt+definition+of+a+cadastre+McLaughlin&hl=en&ie=UTF-8

[120] Widodo, M. S. (2003). *The Needs for Marine Cadastre and Supports of Spatial Data Infrastructures in Marine Environment – A Case Study*. In Proceedings of FIG Working Week 2003, Ecole National de Sciences Géographiques (ENSG) and IGN Marne la Vallée, Paris, April 13–17, 2003. Retrieved from the World Wide Web October, 2003. P. 1 http://www.fig.net/figtree/pub/fig_2003/TS_20/TS20_3_Widodo.pdf

[121] Ibid. P. 3. http://www.fig.net/figtree/pub/fig_2003/TS_20/TS20_3_Widodo.pdf

[122] Ng'ang'a, S., S. Sutherland, and S. Nichols (2002). *Data Integration and Visualisation Requirements for a Canadian Marine Cadastre: Lessons from the Proposed Musquash Marine Protected Area.* ISPRS Commission IV, Symposium 2002, Ottawa, Canada, July 9-12, 2002. P. 2. Retrieved from the World Wide Web October, 2003. http://www.isprs.org/commission4/proceedings/pdfpapers/506.pdf *Citing* McLaughlin, J.D. (1975), The Nature, Function and Design Concepts of Multipurpose Cadastres. Ph.D. Thesis, University of Wisconsin.

these differences are significant enough to alter the cadastral definition for marine areas.

6.4 A Parcel-Based Record and UNCLOS: Breadth and Depth

The United Nations Convention on the Law of the Sea (UNCLOS), may have a profound influence on how the offshore parcel is defined. Firstly, UNCLOS specifies how a ratifying nation's limits are to be drawn. Secondly, UNCLOS specifies the depths or layers at which a ratifying nation begins and ceases to have rights in ocean space. This is illustrated by the following diagram, in which a ratifying nation has rights over air space within the Territorial Sea, but once the Continental Shelf is reached, the nation's rights only begin at the seafloor.

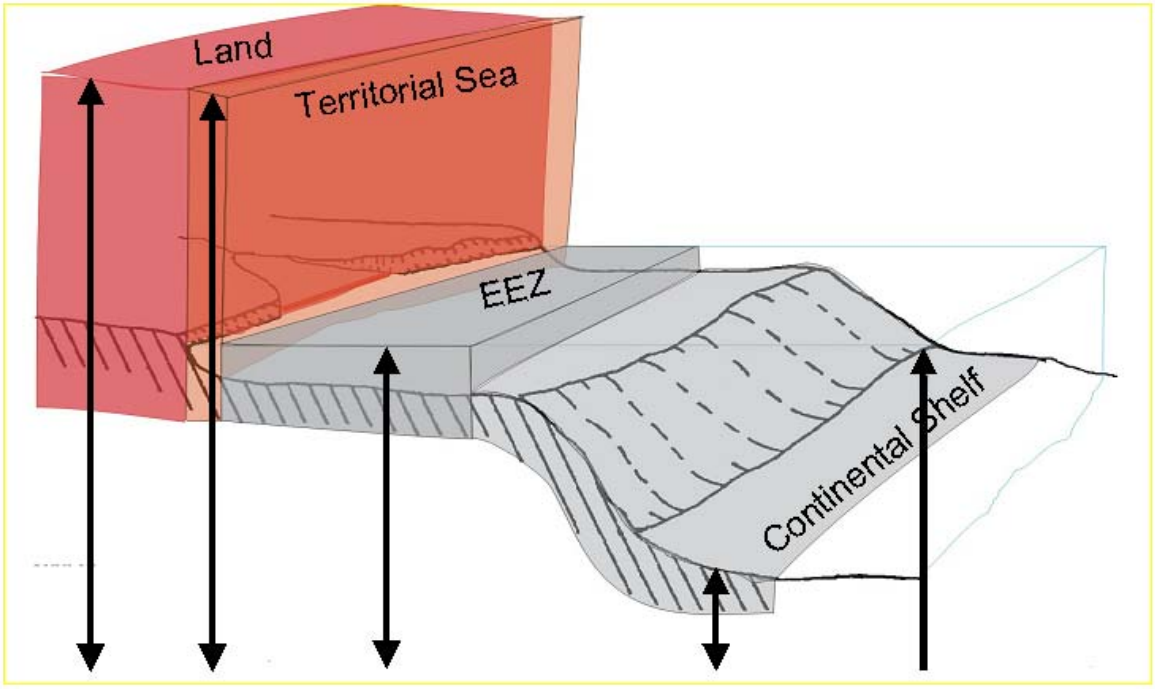


Figure 6.1: Black arrows illustrate the vertical extent of a Nation's sovereign rights in the specified UNCLOS zones. Right hand arrow points to the water surface.

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, as the following paragraphs will illustrate, not least because the land-based cadastral system was developed for an area where nations had absolute jurisdiction. Similarly, evidentiary tools are being used under UNCLOS that have not traditionally been used for the determination of a nation's boundaries. These will be discussed in section [6.6].

Traditionally, the representation of an ownership parcel in a land cadastre is two-dimensional, i.e. x and y, northings and eastings as if the parcel were on the surface of the land. This is illustrated each time we hear the expression "a plot of land." The development of a multipurpose cadastre concept has, however, included a three dimensional spatial unit representing unique, homogeneous, contiguous interests.[123] In a three-dimensional cadastral concept, the traditional view is of rights in three dimensions being tied to the parcel as it exists on the land surface. In other words, the traditional three-dimensional parcel simply extends the usual two-dimensional ownership parcel vertically both skyward and into the earth. Information is requested (or queried) and distributed based on the parcel about which information is desired. In some senses the multipurpose cadastre has also represented a fourth dimension – time. One example of this fourth dimension in a land-based multipurpose cadastre would be time-shared interests.[124]

In both the 2D and 3D cases above, the parcels discussed are usually based on individual ownership rights. In other words, these parcel representations and definitions exist at least in part because the ownership of a piece of property generally comes with certain associated rights. One typical example of such a right is the right to exclude others from the property.[125] Other rights, such as easements or leasehold rights

---

[123] Ng'ang'a S. M., S. Nichols, M. Sutherland and S. Cockburn (2001). "Towards a Multidimensional Marine Cadastre in Support of Good Ocean Governance: New Spatial Information Management Tools and Their Role in Natural Resource Management." Paper #TS 12.3, in *Proceedings of the International Conference on Spatial Information for Sustainable Development*, ISK, FIG, and UN Habitat, Nairobi, Kenya, 2-5 October 2001. P. 8. http://www.ddl.org/figtree/pub/proceedings/nairobi/nganga-nichols-sutherland-cockburn-TS12-3.pdf

[124] Ibid. http://www.ddl.org/figtree/pub/proceedings/nairobi/nganga-nichols-sutherland-cockburn-TS12-3.pdf

[125] Kaiser Aetna v. United States, 444 U.S. 164, 176 (1979). Retrieved on September 14, 2001 from the FindLaw website on the World Wide Web. http://caselaw.lp.findlaw.com/scripts/getcase.pl?navby=case&court=US&vol=444&invol=164.

can usually also be tied to a two-dimensional cadastral parcel because they have typically been granted by a current or past owner of that parcel. Therefore, if we examine a particular land-based cadastral parcel and the records associated with it, we can evaluate what rights have specifically been granted to persons or legal entities other than the owner of that parcel. This is the reason that a parcel has been the traditional unit about which queries can be made in a cadastre.

……
…

In short, [as mentioned above] there are at least two elements of a traditional land cadastre parcel that are usually lacking in marine space.[126] The first is individual ownership of an entire volume of space. The second is a quantity of activities that can be said to be tied to, or take place on, a two-dimensional "plot." In most jurisdictions, marine rights are myriad and are superimposed in such a way that it is extremely difficult to disentangle them.[127] Another complication is added when we consider that it is not possible to physically demarcate boundaries on location offshore but can only do it "by proxy" on charts and other publications (see also section [6.6]).

One potentially helpful device to ensure that the user of a marine cadastre may query relevant information without being hampered by a traditional parcel definition would be a user-defined marine parcel (UDMP) for query purposes. This user-defined marine parcel would allow the user to make queries based on the following: a) a particular area designated by the user where all rights in volumetric ocean space[128] could be viewed by defining the area of interest on the surface of the water; b) a particular volume of ocean space could be user-defined including surface-area and depth values (in this instance, for example, if a user was only interested in water-column rights, they would not have to view the information contained in the cadastre that pertained to seafloor rights); or c) a user-defined parcel could be defined based on either volume or area coupled with the particular right a user wanted to view

---

Loretto v. Teleprompter Manhattan CATV Corp., 458 U.S. 419 (1982). *Fundamentals of Modern Real Property Law, Third Edition*. Rabin, E.H., and R.R. Kwall. The Foundation Press, Inc., Westbury, New York. 1992.

[126] This is not to say that they never exist.

[127] Cockburn, S. and S. Nichols (2002). "Effects of the Law on the Marine Cadastre: Title, Administration, Jurisdiction, and Canada's Outer Limit." In *Proceedings of the XXII FIG International Congress, 2002.* Presented at the XXII FIG International Congress, Washington DC, USA, April 24, 2002. P. 2. http://www.fig.net/figtree/pub/fig_2002/Js12/JS12_cockburn_nichols.pdf

[128] This would include at least air, water surface, water column, seabed and subsurface space.

(for example, a user could query a particular fish stock in a specified volumetric space). If rights in the marine cadastre are unbundled, this third option suggests the ability to view each property right as its own separate cadastral "parcel." The time-varying elements in these user-defined parcels could be time-flagged to add a fourth dimension to the marine cadastre. This fourth dimension may be particularly useful for the management and governance of leasehold and license rights, such as aquaculture leases or fishing licenses.

UNCLOS explicitly enumerates the rights, restrictions and responsibilities a ratifying nation has vis-à-vis offshore areas, and gives rights to other nations as well (e.g.: innocent passage, construction of pipelines and cables). This is in contrast to most land areas where the jurisdiction of the state is complete. A coastal nation will most likely only control spatial cadastral information as to the rights defined by UNCLOS in UNCLOS zones. To what extent is the cadastral system developed under absolute jurisdiction applicable to this marine environment?

6.5 Interests in land : UNCLOS and Sovereign Rights

Comparing the interests that exist in marine space with those on land in many ways illustrates the difference between a land and marine cadastre. One primary function of a land cadastre is to facilitate the administration of property rights. The types of information that may be desirable in a marine cadastre to facilitate effective governance of ocean space are different from those contained in a land cadastre. A land cadastre typically contains information such as who has title to a particular parcel of land, who has easements across that land, zoning information, and possibly leasehold or use rights. The desired contents of a marine cadastre may include the following: shipping lanes, oil and gas leases, fisheries information, conservation information, geophysical information,[129] and information relating to rights in aquaculture, navigation, First Nations' interests, cable laying and flood control, as well as public rights of access,[130] and municipal, county, provincial, and

[129] Williamson, I.P., Leach, J. and Rajabifard, A. (2001) *Marine Cadastres*. Position paper submitted to 7th Meeting of the Permanent Committee on GIS Infrastructure for Asia and the Pacific (PCGIAP), Tsukuba, Japan.
Retrieved from the World Wide Web October, 2003. P. 1
http://www.sli.unimelb.edu.au/maritime/publications/PCGIAP-Cadastral%20WG-Marine%20Cadastre-2001.pdf

[130] Cockburn, S. and S. Nichols (2002). "Effects of the Law on the Marine Cadastre: Title, Administration, Jurisdiction, and Canada's Outer Limit." In *Proceedings of the XXII FIG International*

national jurisdiction and administration, environmental protection areas and military spaces.[131]

……
…

For States parties to UNCLOS, the Nation's rights within each limit identified by UNCLOS are specifically defined and enumerated. In other words, UNCLOS dictates the sovereign interests that are held within each limit defined by the Convention. UNCLOS specifies, for instance, which sovereign rights exist within the Territorial Sea, versus those held in the Exclusive Economic Zone (EEZ), versus those held on the Continental Shelf. On the Continental Shelf, for instance, a nation holds the following rights:

> 1. The coastal State exercises over the continental shelf sovereign rights for the purpose of exploring it and exploiting its natural resources.
> 2. The rights referred to in paragraph 1 are exclusive in the sense that if the coastal State does not explore the continental shelf or exploit its natural resources, no one may undertake these activities without the express consent of the coastal State.
> 3. The rights of the coastal State over the continental shelf do not depend on occupation, effective or notional, or on any express proclamation.
> 4. The natural resources referred to in this Part consist of the mineral and other non-living resources of the seabed and subsoil together with living organisms belonging to sedentary species, that is to say, organisms which, at the harvestable stage, either are immobile on or under the seabed or are unable to move except in constant physical contact with the seabed or the subsoil.[132]

A coastal nation will most likely only control spatial cadastral information as to the rights specified by UNCLOS in UNCLOS zones. This will have a profound influence on the final structure of a marine cadastre, because where other nations are allowed to play a role in the

---

Congress, 2002. Presented at the XXII FIG International Congress, Washington DC, USA, April 24, 2002. P. 2. http://www.fig.net/figtree/pub/fig_2002/Js12/JS12_cockburn_nichols.pdf

[131] Monahan, D., Nichols, S., and Sherin, A. 2003. *Fundamental contents of coastal GIS- the case for a marine cadastre. In* Coastal GIS 2003. Genoa, Italy, October 16-18, 2003. P. 5.

[132] 1982 LOS Convention opened for signature 10 December 1982, UN Doc. A/Conf. 62/122 reprinted in United Nations, Official Text of the United Nations Convention on the Law of the Sea with Annexes and Index (New York: UN Sales No. E83.V.5, 1983). Art. 77

water column or on the seabed the coastal nation will not necessarily have access to all pertinent spatial data. Assuming that one purpose of a marine cadastre is to manage rights in the marine environment, this raises the question: to what extent can a coastal nation effectively manage its own rights without access to all spatial information that may have an effect on these rights?

6.6 Encompassing the Nature and Extent of These Interests: UNCLOS and Boundary Evidence

Having focussed on the nature of interests in a marine cadastre in the last section, the next element of the traditional cadastral definition to address is the way in which a marine cadastre would include the extent of those interests. We have already seen that the cadastral parcel may need to be redefined to account for the volumetric and sometimes time-varying nature of rights in the marine environment, and to deal with the frequent lack of an ownership parcel with the rights that traditionally accompany such a parcel on land.

However, there are other considerations that will also affect the spatial information contained in a marine cadastre: first, the physical *in situ* demarcation of boundaries is rarely possible in a marine environment. "On land, boundary delimitation comprises three steps: 1) definition, or specifying the "locus" of the boundary in the wording of law, 2) delineation, describing the location of the boundary on maps or by co-ordinates and 3) demarcation, the process of physically marking the geographical location of a boundary."[133] In a marine environment, "…demarcation is of necessity combined with delineation, and the medium most frequently used for this combination is the hydrographic chart."[134] "The delineated boundary on a chart or in an official GIS provides the "public notice" function that fences and survey monuments do on land."[135] In some cases, such as the outer limit of the juridical Continental Shelf, the Guidelines of the Commission on the Limits of the Continental Shelf (CLCS) indicate the types and amounts of bathymetry data and other scientific information that will be considered when the CLCS evaluates the scientific legitimacy of a nation's extended continental shelf claim under UNCLOS. "This represents a new

[133] Monahan, D., Nichols, S., and Sherin, A. 2003. *Fundamental contents of coastal GIS- the case for a marine cadastre. In* Coastal GIS 2003. Genoa, Italy, October 16-18, 2003. P. 3. *Citing* Nichols, S. (1983). *Tidal Boundary Delimitation*, Report Technical Report 103, Department of Geodesy and Geomatics Engineering, University of New Brunswick, Fredericton, N.B.
[134] Ibid. P. 3.
[135] Ibid. P. 3.

approach in boundary delimitation as scientific information is actually being used to provide evidence of a juridical boundary."[136]

Second, the boundaries to be contained in a marine cadastre may or may not be final, certain, or complete.[137] Contested or unresolved boundaries are relatively frequent in the marine environment. Other boundaries, while technically not being contested, have other forms of uncertainty associated with them. Some examples of this are certain marine areas in Canada, where both the federal and provincial governments claim jurisdiction. Historical interests may also be uncertain or in dispute.[138] Some interests "…are being newly recognized such as aboriginal title which may not have a strict spatial definition. The datasets of coastal tenure are also frequently incomplete either in terms of spatial coverage or types of interests."[139]

Third, the volumetric nature of marine interests means that the intersection of these interests may not occur on one particular surface. "It is entirely possible that any two marine rights intersect not at the surface of the water, but at some point far below, in the water column or even within the seabed."[140] Somehow, a marine cadastre should account for these intersections for effective marine governance.

Also, a marine cadastre should account for any hierarchy in the interests it contains. This could minimize disputes over a nation's marine environment. UNCLOS is particularly useful in this regard as it specifies not only what rights a coastal ratifying nation has offshore, but also to what extent the coastal nation's rights control or wield influence over the rights of other parties. In the Territorial Sea, for example, a coastal nation may hold sovereignty "…beyond its land territory and internal waters and, in the case of an archipelagic State, its archipelagic

---

[136] Ng'ang'a, S., S. Nichols, and D. Monahan (2003). *The Role of Bathymetry Data in a Marine Cadastre: Lessons from the Proposed Musquash Marine Protected Area.* In Proceedings of the Hydrographic Society of America (THSOA) U.S. Hydro 2003 Conference, Biloxi, Mississippi March 24-27, 2003. P. 2. Retrieved from the World Wide Web October, 2003. http://www.thsoa.org/hy03/9a_1.pdf

[137] Monahan, D., Nichols, S., and Sherin, A. 2003. *Fundamental contents of coastal GIS- the case for a marine cadastre. In* Coastal GIS 2003. Genoa, Italy, October 16-18, 2003. P. 4.

[138] Ibid. P. 4.

[139] Ibid. P. 4.

[140] Cockburn, S. and S. Nichols (2002). "Effects of the Law on the Marine Cadastre: Title, Administration, Jurisdiction, and Canada's Outer Limit." In *Proceedings of the XXII FIG International Congress, 2002.* Presented at the XXII FIG International Congress, Washington DC, USA, April 24, 2002. P. 7. http://www.fig.net/figtree/pub/fig_2002/Js12/JS12_cockburn_nichols.pdf

waters, to an adjacent belt of sea, described as the territorial sea."[141] However, ships of all States "…enjoy the right of innocent passage through the territorial sea."[142]

6.7 Conclusions Regarding the Influence of UNCLOS on a Marine Cadastre

The United Nations Convention on the Law of the Sea will influence a ratified nation's marine cadastre in several ways. First, breadth: UNCLOS will affect some horizontal elements of the marine cadastre, as it specifies certain limits a ratifying nation may implement in ocean space. Second, depth: UNCLOS will affect the vertical dimension, and therefore the volumetric nature and depiction of rights in ocean space. This is true because UNCLOS is specific about the vertical extent to which a nation may exercise its sovereign rights for each particular area of ocean space from the Territorial Sea baselines seaward. Third, sovereign rights: UNCLOS will affect what rights can be included in the ocean areas of a marine cadastre, and hence what spatial information is contained therein. This is apparent in its specific enumeration of the rights a coastal nation has within each limit under the Convention. Lastly, UNCLOS has an effect on the evidence that can be used for boundary demarcation and delineation. It, along with the CLCS Guidelines, specifies the types of scientific information that may be used as evidence of juridical boundaries.

End of Extract

6.8 The UNCLOS and the Marine Cadastre Case Study's Effect on the Hypothesized Legal Framework

6.8.1 The Administration and Governance of Property Interests

While this last case study does not alter the framework established using the first UNCLOS case study (see Figure 6.2, below), it does show that the same law applied to

[141] 1982 LOS Convention opened for signature 10 December 1982, UN Doc. A/Conf. 62/122 reprinted in United Nations, Official Text of the United Nations Convention on the Law of the Sea with Annexes and Index (New York: UN Sales No. E83.V.5, 1983). Art. 2
[142] Ibid., Art. 17

surveyors doing different jobs will influence them in similar ways. UNCLOS will affect the administration and governance of property interests in a marine cadastre. As mentioned above, UNCLOS specifies which sovereign rights a nation has within each specified zone, and therefore which rights or resources can be administered by the nation. There is no doubt that during the negotiation of the terms of UNCLOS, nations spoke as to what was reasonable vis-à-vis sovereign rights within a given area (see section 3.3.1.3).

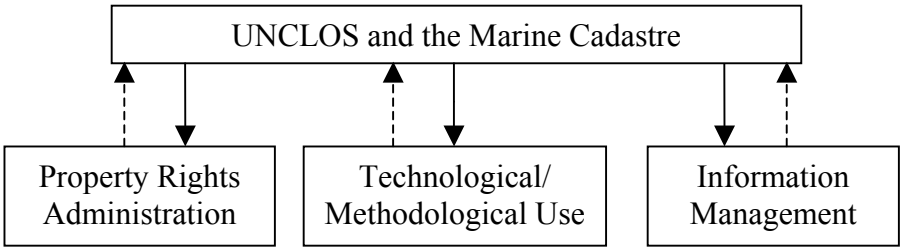


Figure 6.2: The Framework for the UNCLOS-Marine Cadastre Case Study

6.8.2 Technological and Methodological Use

The application of certain elements of UNCLOS will influence both the vertical and horizontal measurements used in a marine cadastre. This is not only true for a nation's outer limit, but also for the other UNCLOS zones. These measurements will also have an effect on the extent of individual rights in a marine cadastre, as these will be limited by the spatial extent over which the coastal nation may grant these rights or interests.

6.8.3 Information Management

Apart from the hierarchical considerations mentioned in Chapter 3, in the case of UNCLOS and a marine cadastre, scientific information is being used under UNCLOS to provide evidence of juridical boundaries. This information may require new methods of management, as according to the CLCS Guidelines, it must carry the scientific data in the particular form of evidence that the CLCS will consider. The results of the submission process must then be deposited with the Secretary-General of the United Nations, including "…geodetic data" [UNCLOS, 1982, P.28].

6.8.4 Reverse Effects

The reverse effects upon the law (UNCLOS, in this case), of pre-existing information management, technological and methodological use, and administration of property interests, remain largely the same as in Chapter 3. This leaves the Legal Framework, which is the purpose of this thesis, unchanged from its first iteration after the first UNCLOS case study. See the final Legal Framework diagram below, Figure 6.3:

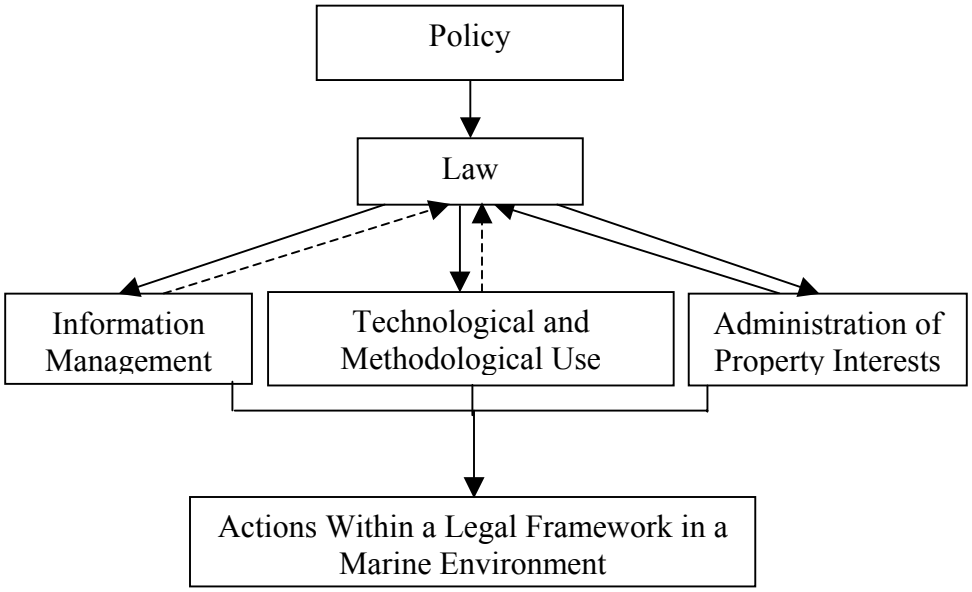


Figure 6.3: The Legal Framework for spatial work in offshore and coastal environments.

CHAPTER 6 REFERENCES

1982 LOS Convention opened for signature 10 December 1982, UN Doc. A/Conf. 62/122 reprinted in United Nations, Official Text of the United Nations Convention on the Law of the Sea with Annexes and Index (New York: UN Sales No. E83.V.5, 1983).

Black, H.C., 1990, *Black's Law Dictionary, 6th Edition*. (6th Edition by The Publisher's Editorial Staff – Coauthors J. R. Nolan and J. M. Nolan-Haley, Contributing Authors M.J. Connolly, S.C. Hicks, M.N. Alibrandi), West Publishing Company, St. Paul Minnesota.

Cockburn, S., D. Monahan, and Nichols, S. (2003). "UNCLOS' Potential Influence on a Marine Cadastre: Depth, Breadth, and Sovereign Rights." In *Proceedings of the Advisory Board on the Law of the Sea to the International Hydrographic Organization (ABLOS) Conference "Addressing Difficult Issues in UNCLOS."* Presented at the International Hydrographic Bureau, Monaco, October 2003. http://www.gmat.unsw.edu.au/ablos/ABLOS03Folder/PAPER1-1.PDF

Cockburn, S. and S. Nichols (2002). "Effects of the Law on the Marine Cadastre: Title, Administration, Jurisdiction, and Canada's Outer Limit." In *Proceedings of the XXII FIG International Congress, 2002*. Presented at the XXII FIG International Congress, Washington DC, USA, April 24, 2002. http://www.fig.net/figtree/pub/fig_2002/Js12/JS12_cockburn_nichols.pdf

Commission on the Limits of the Continental Shelf, *Scientific and Technical Guidelines of the Commission on the Limits of the Continental Shelf*, CLCS 11, Adopted 13 May 1999. Retrieved from the World Wide Web August 22, 2001 http://www.un.org/Depts/los/clcs_new/documents/CLCS_11.htm

Kaiser Aetna v. United States, 444 U.S. 164, 176 (1979). Retrieved on September 14, 2001 from the FindLaw website on the World Wide Web. http://caselaw.lp.findlaw.com/scripts/getcase.pl?navby=case&court=US&vol=444&invol=164.

Loretto v. Teleprompter Manhattan CATV Corp., 458 U.S. 419 (1982). *Fundamentals of Modern Real Property Law, Third Edition*. Rabin, E.H., and R.R. Kwall. The Foundation Press, Inc., Westbury, New York. 1992.

Monahan, D., Nichols, S., and Sherin, A. (2003). *Fundamental contents of coastal GIS-the case for a marine cadastre. In* Coastal GIS 2003. Genoa, Italy, October 16-18, 2003.

Monahan D., and Nichols, S. (2002). *Hydrography's Role in Marine Boundary Delimitation*. *In* Hydro International, **6**(9): 7-9, 2002.

Ng'ang'a, S., M. Sutherland, S. Cockburn and S. Nichols (2001). "Toward a 3D Marine Cadastre in Support of Good Ocean Governance." Presented at *Registration of Properties in Strata*, International Workshop on 3D Cadastres, Delft, Netherlands, 28-30 November 2001. Retrieved on September 14, 2001 from the FindLaw website on the World Wide Web. http://caselaw.lp.findlaw.com/scripts/getcase.pl?navby=case&court=US&vol=444&invol=164.

Ng'ang'a S. M., S. Nichols, M. Sutherland and S. Cockburn (2001). "Towards a Multidimensional Marine Cadastre in Support of Good Ocean Governance: New Spatial Information Management Tools and Their Role in Natural Resource Management." Paper #TS 12.3, in *Proceedings of the International Conference on Spatial Information for Sustainable Development*, ISK, FIG, and UN Habitat, Nairobi, Kenya, 2-5 October 2001. http://www.ddl.org/figtree/pub/proceedings/nairobi/nganga-nichols-sutherland-cockburn-TS12-3.pdf

Ng'ang'a, S., M. Sutherland, and S. Nichols (2002). *Data Integration and Visualisation Requirements for a Canadian Marine Cadastre: Lessons from the Proposed Musquash Marine Protected Area.* ISPRS Commission IV, Symposium 2002, Ottawa, Canada, July 9-12, 2002. Retrieved from the World Wide Web October, 2003. http://www.isprs.org/commission4/proceedings/pdfpapers/506.pdf

Ng'ang'a, S., S. Nichols, and D. Monahan (2003). *The Role of Bathymetry Data in a Marine Cadastre: Lessons from the Proposed Musquash Marine Protected Area.* In Proceedings of the Hydrographic Society of America (THSOA) U.S. Hydro 2003 Conference, Biloxi, Mississippi March 24-27, 2003. Retrieved from the World Wide Web October, 2003. http://www.thsoa.org/hy03/9a_1.pdf

Sutherland, M. (2003). The Outcomes of the UNB-FIG meeting on Marine Cadastre Issues, University of New Brunswick, Fredericton, NB, Canada.

Widodo, M. S. (2003). *The Needs for Marine Cadastre and Supports of Spatial Data Infrastructures in Marine Environment – A Case Study*. In Proceedings of FIG Working Week 2003, Ecole National de Sciences Géographiques (ENSG) and IGN Marne la Vallée, Paris, April 13–17, 2003. Retrieved from the World Wide Web October, 2003. http://www.fig.net/figtree/pub/fig_2003/TS_20/TS20_3_Widodo.pdf

Williamson, I. (2003). *The Cadastral Concept.* Land Administration 451-418/607 Lecture 4, 2003, PowerPoint Presentation. Retrieved from the World Wide Web October, 2003. http://216.239.41.104/search?q=cache:94F7PlBEYAwJ:www.sli.unimelb.edu.au/subjects/451/418/Lecture%25204%2520-%2520Cadastral%2520Concept%2520-%25202003.ppt+definition+of+a+cadastre+McLaughlin&hl=en&ie=UTF-8

Williamson, I.P., Leach, J. and Rajabifard, A. (2001) *Marine Cadastres*. Position paper submitted to 7th Meeting of the Permanent Committee on GIS Infrastructure for Asia and the Pacific (PCGIAP), Tsukuba, Japan. Retrieved from the World Wide Web October, 2003. http://www.sli.unimelb.edu.au/maritime/publications/PCGIAP-Cadastral%20WG-Marine%20Cadastre-2001.pdf

7: CONCLUSIONS AND RECOMMENDATIONS

7.2 Conclusions

This thesis had several goals and questions enumerated at its inception, including the following goals:

(1) to examine case studies from major sources of law including international convention, regional legislation, and arbitration panel decisions in order to determine the common threads affecting the efforts of those working with spatial information in coastal and offshore environments.

(2) to develop a fundamental legal framework that may be used by those working with spatial information in coastal and offshore environments to determine the essential ways in which law and policy affect their work.

as well as the following questions:

(1) Does the law affect those working with spatial information in coastal and offshore environments similarly in a variety of boundary situations?

(2) Does the law affect spatial work in marine environments similarly when it comes from different sources, i.e.: do international conventions affect those working with spatial information in coastal and offshore environments similarly to the ways local boundary arbitrations or regional legislation do?

(3) Can a legal framework be built which addresses the major ways in which marine policy and law affect those working with spatial information in coastal and offshore environments?

The case studies that were examined from major sources of law including international convention, regional legislation, and arbitration panel decisions have helped to answer the first and second questions. A variety of boundary situations and a variety of legal sources did not affect the hypothesized legal framework much. It was somewhat surprising to note to what extent certain legal sources were influenced by pre-existing technologies, methodologies, and administrative and information management norms. These, however, can be viewed as being similar to legal precedent. When the law is attempting to deal with boundary-making, it generally acknowledges pre-existing survey methods or technologies as being the most acceptable. That the law influences surveyors, as Survey Law in Canada suggests, is indisputably the case. That the work of those working with spatial information in coastal and offshore environments can also influence boundary law is also unquestionably true.

The second goal of the thesis, to develop a fundamental legal framework that may be used those working with spatial information in coastal and offshore environments to determine the essential ways in which law and policy affect their work, has also been met. While the Framework may be subject to more specificity with further research, this thesis does establish a useful framework to serve as a touchstone to those working with spatial information in the marine environment and within which the law may be read to assess the ways in which it will affect the surveyor.

Additional contributions include the analysis of four situations that involve a variety coastal and offshore rights, interests, claims and spatial limits; this analysis is unique in that the case studies have been conducted to highlight the spatial complexity

within a legal context, and that the framework design was tested as to the ways in which rights, interests, etc. can be viewed in a variety of contexts to build the information and administration systems needed to support good ocean governance. The legal framework for a marine cadastre and its components, including the framework's definition of Boundary Laws, Rights Laws, and Formulaic laws; and the assessment that Boundary Laws, Rights Laws, and Formulaic laws may all play a role in the establishment of a Marine Cadastre; are other contributions.

7.1 Recommendations

7.1.1 Using the Framework

Some main parameters of this study should be reiterated at this point. Ocean boundary law is relatively new in the vast subject of "the law," and because marine boundary law is still evolving and changing, it is impossible to contemplate every legal permutation that may affect the surveyor in the marine environment. Case Studies were carried out with the framework at an overview, or "high" level. This means that the Framework described in this thesis should be used as a touchstone, or starting point, when examining the law for the ways it may affect spatial tasks in the marine environment.

This should be carried out with additional research into the specific or relevant body of law and for any new precedents (which may have, in effect, altered or further specified the way in which a statute or convention must be read), jurisdictional

differences, and regulations pertaining to the law at hand. The use of an attorney may be necessary for this evaluation.

7.1.2 Further Research

This thesis points out a few areas for further research. Further Case Studies could be developed to include regulations, other precedents or additional sources of law such as national legislation. More importantly, the Framework could be made more specific, or separate specific Frameworks could be developed for a variety of situations and legal questions. A more specific variety of legal framework may attempt to detail every source of law affecting technological and methodological use, administration of property interests, and information management for a particular area – within provincial waters, for example.

Also, the framework was most carefully examined and tested in terms of the bi-directional influence between the law, and the three main ways it affects spatial work in the marine environment. However, additional tests could be done to evaluate the influence of other parts of the framework on each other. For example, do the actions of those carrying out spatial work in a marine environment affect policy? More research would definitely be useful in these areas.

Lastly, more research could be carried out to determine with greater certainty the similarities and differences between the marine environment and land. For example, more research would be useful to examine the similarities and differences between the marine and land environments when it comes to the overview framework; more research would also be of use in determining the similarities and differences between

the marine cadastre legal framework and visualisation issues and the legal and visualisation issues in the land cadastre arena.

REFERENCES

1958 Convention on the Continental Shelf. Done at Geneva, on 29 April 1958.

1982 LOS Convention opened for signature 10 December 1982, UN Doc. A/Conf. 62/122 reprinted in United Nations, Official Text of the United Nations Convention on the Law of the Sea with Annexes and Index (New York: UN Sales No. E83.V.5, 1983).

Arbitration Between Newfoundland and Labrador and Nova Scotia Concerning Portions of the Limits of Their Offshore Areas as Defined in the Canada-Nova Scotia Offshore Petroleum Resources Accord Implementation Act and the Canada-Newfoundland Atlantic Accord Implementation Act: Award of the Tribunal in the Second Phase. Ottawa, March 26, 2002. Retrieved from: http://www.boundary-dispute.ca, April 2002.

Bevin, T. (1999). Cadastre 2014 Reforms in New Zealand. In *the Coastal Cadastre: Onland, Offshore. Proceedings from the New Zealand Institute of Surveyors & FIG Commission VII Conference*, Waitangi, New Zealand.

Black, H.C. (1979). *Black's Law Dictionary, 5th Edition*. (5th Edition by The Publisher's Editorial Staff – Contributing authors J. R. Nolan and M.J. Connolly), West Publishing Company, St. Paul Minnesota.

Black, H.C. (1990). *Black's Law Dictionary, 6th Edition*. (6th Edition by The Publisher's Editorial Staff – Coauthors J. R. Nolan and J. M. Nolan-Haley, Contributing Authors M.J. Connolly, S.C. Hicks, M.N. Alibrandi), West Publishing Company, St. Paul Minnesota.

Borissova, I., P.A. Symonds, R. Gallagher, B.C. Cotton and G. Hill (1999). "A Set of Integrated Tools based on Arcview for Defining the Outer Limit of Australia's Extended Continental Shelf". In Proceedings of the International Conference on Technical Aspects of Maritime Boundary Delineation and Delimitation, International Hydrographic Bureau, Monaco, September 8-9.

British Oceanographic Data Centre-BODC (2001). The GEBCO Digital Data Atlas. http://www.bodc.ac.uk/frames/index2.html?../projects/gebco/index.html&2, accessed, September 2001.

Campbell, B. (1989). "The Canadian Legal System." Chapter 1 in *Survey Law in Canada*, Canadian Institute of Surveying and Mapping, Carswell, Toronto.

Canada Oil and Gas Land Regulations, C.R.C c 1518

Canada-Newfoundland Atlantic Accord Implementation Act (1987, c. 3). s. 3. Consolidated Statutes and Regulations. Retrieved from: http://laws.justice.gc.ca/en/C-7.5/21662.html August 2001.

Canada-Nova Scotia Agreement on Joint Management and Revenue Sharing [1988, c. 28]. Consolidated Statutes and Regulations. Retrieved from the World Wide Web August 2001. http://laws.justice.gc.ca/en/C-7.5/21662.html

Canadian Hydrographic Service (2000). *Vertical Datums and Water Levels*. Retrieved from the World Wide Web December 21, 2000. http://biachss.bur.dfo.ca/danp/datums.html

Centre on Governance (2000). "What is governance?" Centre on Governance, University of Ottawa. http://www.governance.uottawa.ca/english/overview/o_definition, accessed November 2000.

Cockburn, S. and S. Nichols (2002). "Effects of the Law on the Marine Cadastre: Title, Administration, Jurisdiction, and Canada's Outer Limit." In *Proceedings of the XXII FIG International Congress, 2002.* Presented at the XXII FIG International Congress, Washington DC, USA, April 24, 2002. http://www.fig.net/figtree/pub/fig_2002/Js12/JS12_cockburn_nichols.pdf

Cockburn, S. and S. Nichols (2002). "Factors in Inter-provincial Boundary Delimitation: Points of Interest for Surveyors in the Newfoundland & Labrador/Nova Scotia Boundary Arbitration." Contract report for Service New Brunswick, Fredericton, New Brunswick, November 2002.

Cockburn, S., D. Monahan, and Nichols, S. (2003). "UNCLOS' Potential Influence on a Marine Cadastre: Depth, Breadth, and Sovereign Rights." In *Proceedings of the Advisory Board on the Law of the Sea to the International Hydrographic Organization (ABLOS) Conference "Addressing Difficult Issues in UNCLOS."* Presented at the International Hydrographic Bureau, Monaco, October 2003. http://www.gmat.unsw.edu.au/ablos/ABLOS03Folder/PAPER1-1.PDF

Cockburn, S., S. Nichols, D. Monahan and T. McDorman (2001). "Intertwined Uncertainties: Policy and Technology on the Juridical Continental Shelf." In *Proceedings of the Advisory Board on the Law of the Sea to the International Hydrographic Organization (ABLOS) Conference "Accuracies and Uncertainties in Maritime Boundaries and Outer Limits."* Presented at the

International Hydrographic Bureau, Monaco, October 2001. http://www.gmat.unsw.edu.au/ablos/COCKBURN.PDF

Commission on the Limits of the Continental Shelf (1999). *Scientific and Technical Guidelines of the Commission on the Limits of the Continental Shelf*, CLCS 11, Adopted 13 May 1999. Retrieved from the World Wide Web August 22, 2001 http://www.un.org/Depts/los/clcs_new/documents/CLCS_11.htm

Commission on the Limits of the Continental Shelf (2001). *Rules of Procedure of the Commission on the Limits of the Continental Shelf*, New York, 21-25 May 2001. Retrieved from the World Wide Web April 4, 2004. http://ods-dds-ny.un.org/doc/UNDOC/GEN/N01/239/51/PDF/N0123951.pdf?OpenElement

Delegation of Canada, *Written Statement by the Delegation of Canada* Dated 2 April 1980, UN Doc. A/Conf. 62/WS/4 United Nations, Third Conference on the Law of the Sea, Ninth Session, New York.

Department of Environment and Local Government (2000). *Provincial Land Use Policy for New Brunswick's Coastal Lands: A Proposal*.

Department of Environment and Local Government (2002). *A Coastal Areas Protection Policy for New Brunswick*. Retrieved from the World Wide Web May, 2004. http://www.gnb.ca/0009/0371/0002/Coastal-E.pdf

DOALOS (2003). United Nations Division for Ocean Affairs and the Law of the Sea, *The Law of the Sea: Definition of the Continental Shelf*, (New York, UN Sales No. E.93.V.16, 1993).

DOALOS (2004). United Nations Division for Ocean Affairs and the Law of the Sea, "Purpose of the Commission." Retrieved from the World Wide Web April 4, 2004

Eckert, R. D. (1979). The Enclosure of Ocean Resources: Economics and the Law of the Sea. Hoover Institution Press, Stanford University, Stanford, California.

Elema, I. and K. de Jong (1999). The Law of the Sea in the North Sea. In *Proceedings of the International Conference on Technical Aspects of Maritime Boundary Delineation and Delimitation*, International Hydrographic Bureau, Monaco, September 8-9, 1999.

Elferink (2001). ILA Committee on Legal Issues of the Outer Continental Shelf, Preliminary Report on the Limits of the Outer Continental Shelf (Draft), Prepared by Dr. Alex G. Oude Elferink, Utrecht University, Utrecht, the Netherlands, 4 September 2001. This is only a draft document.

Fédération Internationale des Géomètres (date unknown). *FIG Definition of Surveyor*. Retrieved from the World Wide Web on January 9, 2003.

Food and Agriculture Organization of the United Nations (1998). *FAO Guidelines: Integrated Coastal Area Management and Agriculture, Forestry and Fisheries*. Publishing Management Group, FAO Information Division, Rome.

Gardiner, P.R.R., 1987, "The Limits of the Area Beyond National Jurisdiction – Some Problems With Particular Reference to the Role of the Commission on the Limits of the Continental Shelf," Chapter 5 in: *Maritime Boundaries and Ocean Resources*, G. Blake, Ed., Croom Helm, London & Sydney

Gault, I. T., (1985). "Jurisdiction Over The Petroleum Resources of the Canadian Continental Shelf: The Emerging Picture." In *Alberta Law Review*, Vol. XXIII, No. 1. [1985].

Gomes, G. (1998). "The review of the NOAA National Coastal Zone Management Programs for Estuary and Coastal Wetland Protection." Retrieved from the World Wide Web in September 2000. http://www.oceansconservation.com/iczm/gomes.htm.

Gornitz, V. (1996). *Sea Level Rise*. NASA Goddard Institute for Space Studies. Retrieved from the World Wide Web December 21, 2000. Last updated: 1999:08:12

Governments Awaken to Coastal Threat (1999). DPC: Dredging and Port Construction, Nov. 99, Vol. 26 Issue 11, p. 29. Retrieved from the World Wide Web November 21, 2000. http://ehostvgw3.epnet.com/ehost1.asp?key=204.179.122.141_8000_-1052834603&site=ehost&return=n&profile=web

Groten, E. (1999). "Coastal Boundaries and Vertical Datums." In *Proceedings of the International Conference on Technical Aspects of Maritime Boundary Delineation and Delimitation*, International Hydrographic Bureau, Monaco, September 8-9, 1999.

Hardy, I.T., 1998, "Copyright Office Issues New Report on the Future of Copyright in a Networked World," *Information Today*, Vol. 15 Issue 9, P.33, Retrieved on 31 January 2001 the Academic Search Elite Database on the World Wide Web. http://ehostvgw16.epnet.com/

Hirst, B., B. Murphy, and P. Collier (1999). An Overview of Australian Maritime Zone Boundary Definition. In *Proceedings of the International Conference on*

Technical Aspects of Maritime Boundary Delineation and Delimitation, International Hydrographic Bureau, Monaco, September 8-9, 1999.

Holmes, C.(1999). "The Relevance of MultiBeam Data in the Coastal Cadastre. In the Coastal Cadastre: Onland, Offshore." In *Proceedings from the New Zealand Institute of Surveyors & FIG Commission VII Conference*, Waitangi, New Zealand.

Hoogsteden, C.C., and W.A. Robertson (1998). On Land - Off Shore: Strategic Issues in Building a Seamless Cadastre for New Zealand. In *XXI International Congress Proceedings: Developing the Profession in a Developing World*, International Federation of Surveyors, Commission 7, Cadastre and Land Management, p. 32-48, Brighton.

Hoogsteden, C.C., and W.A. Robertson (1999). Re-engineering New Zealand's Cadastre: Strategic Issues in Building an Onland-Offshore Cadastre. GIM International, Vol. 13, No. 6, p. 7-9, June 1999.

IHO, IOC and CHS, (1984) *GEBCO - General Bathymetric Chart of the Oceans* (5th Edition), International Hydrographic Organization/ Intergovernmental Oceanographic Commission/ Canadian Hydrographic Service, Ottawa, Canada.

ILA Committee on Legal Issues of the Outer Continental Shelf, 2001, *Preliminary Report on the Limits of the Outer Continental Shelf (Draft)*, Prepared by Dr. Alex G. Oude Elferink, Utrecht University, Utrecht, the Netherlands, 4 September 2001.

International Court of Justice. (1981-1984). Delimitation of the Maritime Boundary in the Gulf of Maine Area (Canada/United States of America). Retrieved from the World Wide Web May, 2004. http://www.icj-cij.org/icjwww/icases/icigm/icigmframe.htm

International Court of Justice. (1982-1985). Continental Shelf (Libyan Arab Jamahiriya/Malta. Retrieved from the World Wide Web May, 2004. http://www.icj-cij.org/icjwww/icases/ilm/ilmframe.htm

International Court of Justice. (1988-1993). Maritime Delimitation in the Area Between Greenland and Jan Mayen (Denmark v. Norway). Retrieved from the World Wide Web May, 2004. http://www.icj-cij.org/icjwww/icases/igjm/igjmframe.htm

International Hydrographic Organization, 1998, *IHO Standards for Hydrographic Surveys*, IHB, Special Publication No. 44, 4th Edition.

International Seabed Authority (date unknown). Retrieved from the World Wide Web on April 4, 2004. http://www.isa.org.jm/en/seabedarea/TechBrochures/ENG2.pdf

Johnston, D. M. (1988). *The Theory and History of Ocean Boundary-Making*. McGill-Queens University Press, Kingston and Montreal.

Jones, M.T. (1997) "The GEBCO Digital Atlas; A Seamless, Digital, Bathymetric Contour Chart of the World's Oceans," *Hydro International*, Vol.1, No.5, pp.46-47.

Kaiser Aetna v. United States, 444 U.S. 164, 176 (1979). Retrieved on September 14, 2001 from the FindLaw website on the World Wide Web. http://caselaw.lp.findlaw.com/scripts/getcase.pl?navby=case&court=US&vol=444&invol=164.

LaForest, G.V. and Associates (1973). *Water Law in Canada: The Atlantic Provinces*. Regional Economic Expansion, Information Canada, Ottawa, 1973.

Larsson, G. (1991). *Land Registration and Cadastral Systems: Tools for Land Information and Management*. John Wiley and Sons, New York.

Loretto v. Teleprompter Manhattan CATV Corp., 458 U.S. 419 (1982). *Fundamentals of Modern Real Property Law, Third Edition*. Rabin, E.H., and R.R. Kwall. The Foundation Press, Inc., Westbury, New York. 1992.

Mandia, S. A. (date unknown). *Long Island South Shore Hurricane Storm Surge Maps.* Retrieved from the World Wide Web on December 20, 2000. http://www2.sunysuffolk.edu/mandias/38hurricane/storm_surge_maps.html

McLaughlin, J.D. [1975]. The Nature, Function and Design Concepts of Multipurpose Cadastres. Unpublished Ph.D. Dissertation in Civil and Environmental Engineering, Madison: University of Wisconsin, 1975.

Miles, E. L. (1998). "The concept of ocean governance: Evolution towards the 21st century and the principle of sustainable ocean use. Paper prepared for SEAPOL workshop on ocean governance and system compliance in the Asia-Pacific context. Rayong, Thailand, 1997.

Monahan D., and Nichols, S. (2002). *Hydrography's Role in Marine Boundary Delimitation*. *In* Hydro International, **6**(9): 7-9, 2002.

Monahan, D. and D. E. Wells, (2001), "Deep Water Challenges to Hydrography Stimulated by the United Nations Convention on Law of the Sea (UNCLOS),"

US Hydrographic Conference, 21-24 May, Norfolk, VA, un-paginated CD-ROM.

Monahan, D. and D. E. Wells, (2001), "The Suitability of the International Hydrographic Organization's 'Standards for Hydrographic Surveys, Version 4' for Determining Depth Accuracy in the Scientific and Technical Guidelines of the United Nations Commission On The Limits Of The Continental Shelf." *Proceedings, International conference on Technical Aspects Of Maritime Boundary Delineation and Delimitation*. International Hydrographic Organization, International Association of Geodesy, International Board on Technical Aspects of Law of the Sea (ABLOS), Monaco, 18-19 October 2001.

Monahan, D. and L. Mayer (1999). An Examination of Publicly Available Bathymetric Data Sets Using Digital Mapping Tools to Determine their Applicability to Article 76 of UNCLOS. In *Proceedings of the International Conference on Technical Aspects of Maritime Boundary Delineation and Delimitation*, International Hydrographic Bureau, Monaco, September 8-9, pp 183-190.

Monahan, D. and S. Nichols (1999). Fuzzy Boundaries in a Sea of Uncertainty: Canada's Offshore Boundaries. In *The Coastal Cadastre - Onland, Offshore - Proceedings of the New Zealand Institute of Surveyors Annual Meeting*, Bay of Islands, NZ, Oct 9-15, pp. 33-43.

Monahan, D., and D. E. Wells, (2000). "IHO SP 44 Standards for Hydrographic Surveys and the Demands of the New Century," In *Proceedings, Canadian Hydrographic Conference 2000*, Montreal.

Monahan, D., S. Nichols, and A. Sherin (2003). *Fundamental contents of coastal GIS- the case for a marine cadastre. In* Coastal GIS 2003. Genoa, Italy, October 16-18, 2003.

Monahan, D., S. Nichols, S. Ng'ang'a, and R. van de Poll (2001). "Assessing the Impact of Uncertainties in the Locations of 'baselines from which the breadth of the Territorial Sea is measured' on the Outer Limit of the Juridical Continental Shelf" In *Proceedings of the Advisory Board on the Law of the Sea to the International Hydrographic Organization (ABLOS) Conference "Accuracies and Uncertainties in Maritime Boundaries and Outer Limits."* Presented at the International Hydrographic Bureau, Monaco, October 2001. http://www.gmat.unsw.edu.au/ablos/ABLOS01Folder/MONAHAN.PDF

Moyer, D.D. and K.P. Fisher (1973). *Land Parcel Identifiers for Information Systems*. Chicago: American Bar Association.

MSN Encarta Resources for Interactive Learning: Encyclopedia (date unknown). *Sea Level*. Retrieved from the World Wide Web December 21, 2000. http://encarta.msn.com/find/Concise.asp?z=1&pg=2&ti=761569928&cid=3#p3

National Research Council (1980). Need for a Multipurpose Cadastre. Panel on a Multipurpose Cadastre, National Academy Press, Washington, D.C.

National Research Council (1983). Procedures and Standards for a Multipurpose Cadastre. Panel on a Multipurpose Cadastre, National Academy Press, Washington, D.C.

Ng'ang'a, S., M. Sutherland, and S. Nichols (2002). *Data Integration and Visualisation Requirements for a Canadian Marine Cadastre: Lessons from the Proposed Musquash Marine Protected Area.* ISPRS Commission IV, Symposium 2002, Ottawa, Canada, July 9-12, 2002. Retrieved from the World Wide Web October, 2003.

Ng'ang'a, S., M. Sutherland, and S. Nichols (2002). *Data Integration and Visualisation Requirements for a Canadian Marine Cadastre: Lessons from the Proposed Musquash Marine Protected Area.* ISPRS Commission IV, Symposium 2002, Ottawa, Canada, July 9-12, 2002. Retrieved from the World Wide Web October, 2003.

Ng'ang'a, S., M. Sutherland, S. Cockburn, and S. Nichols (2004). "Toward a 3D Marine Cadastre in Support of Good Ocean Governance: A Review of the Technical Framework Requirements." In *Computers, Environment and Urban Systems (CEUS)*, Volume 28, Issue 5, September 2004, Pages 443-470, Cadastral Systems III.

Ng'ang'a S. M., S. Nichols, M. Sutherland and S. Cockburn (2001). "Towards a Multidimensional Marine Cadastre in Support of Good Ocean Governance: New Spatial Information Management Tools and Their Role in Natural Resource Management." Paper #TS 12.3, in *Proceedings of the International Conference on Spatial Information for Sustainable Development*, ISK, FIG, and UN Habitat, Nairobi, Kenya, 2-5 October 2001. http://www.ddl.org/figtree/pub/proceedings/nairobi/nganga-nichols-sutherland-cockburn-TS12-3.pdf

Ng'ang'a, S., M. Sutherland, S. Cockburn and S. Nichols (2001). "Toward a 3D Marine Cadastre in Support of Good Ocean Governance." Presented at *Registration of Properties in Strata*, International Workshop on 3D Cadastres, Delft, Netherlands, 28-30 November 2001. Retrieved on September 14, 2001 from the FindLaw website on the World Wide Web.

http://caselaw.lp.findlaw.com/scripts/getcase.pl?navby=case&court=US&vol=444&invol=164.

Ng'ang'a, S., S. Nichols, and D. Monahan (2003). *The Role of Bathymetry Data in a Marine Cadastre: Lessons from the Proposed Musquash Marine Protected Area.* In Proceedings of the Hydrographic Society of America (THSOA) U.S. Hydro 2003 Conference, Biloxi, Mississippi March 24-27, 2003. Retrieved from the World Wide Web October, 2003. http://www.thsoa.org/hy03/9a_1.pdf

Nichols, S. (1983). *Tidal Boundary Delimitation*, Technical Report 103, Department of Geodesy and Geomatics Engineering, University of New Brunswick, Fredericton, N.B.

Nichols, S. (1989). "Water Boundaries – Coastal." Chapter 5 in *Survey Law in Canada*, Canadian Institute of Surveying and Mapping, Carswell, Toronto, Canada.

Nichols, S., and D. Monahan (2000). The Contribution of Hydrographic Charting to the Resolution and Portrayal of Offshore Property and Jurisdictional Boundaries. Proceedings of the Canadian Hydrographic Conference 2000, Montreal, Canada.

Nichols, S., D. Monahan and M. D. Sutherland (2000). "Good Governance of Canada's Offshore and Coastal Zone: Towards and understanding of the Maritime Boundary Issues." In *Geomatica*, Vol. 54, No. 4, pp. 415-424.

Nichols, S., I. Edwards, J. Dobbin, K. Komjathy, and S. Hanham (1997). "Real Property Issues in the Marine Aquaculture Industry in New Brunswick." Contract Report for the Department of Fisheries and Aquaculture, Fredericton; NB.

Nichols, S., J. Dobbin, S. Ng'ang'a, S. Cockburn, M. Sutherland, K. Cove, and T. Beran (2001). "Roles and Responsibilities for Surveying in Offshore Canada Lands." Contract report prepared for Natural Resources Canada, Legal Surveys Division, September 2001.

Nichols, S., M. Sutherland, S. Ng'ang'a, and D. Monahan (2001). *Report on the proceedings of the Association of Canadian Land Surveyors*. Stakeholders Workshop on Canada Lands Offshore. Published by the Association of Canada Lands Surveyors.

Outer Continental Shelf Lands Act 43 U.S.C. 1331 et seq.

Paquet, G. (1994). "Reinventing Governance." In *Opinion Canada,* Vol. 2, No. 2, April.

Paquet, G. (1997). "Alternative service delivery: Transforming the practices of governance." In *Alternative Service Delivery: Sharing governance in Canada.*

Eds. Ford, R. and D. Zussman, KPMG • The Institute of Public Administration • University of Ottawa Libraries.

Payoyo, P. B. (1994). "Editor's introduction." In *Ocean Governance: Sustainable Development of the Seas*. Ed. Payoyo, United Nations University Press, Tokyo, New York, Paris.

Percy, J.A. (date unknown). *Tides of Change: Natural Processes in the Bay of Fundy*, In: BOFEP Fundy Issues, #2, Autumn 1996. Retrieved from the World Wide Web on November 24, 2000. http://fox.nstn.ca/~carp/fundis2.html

Pluijmers, Y. and H.J. Onsrud, (1997) "Commercial Sector Perspectives Regarding Legal Methods for Protecting Spatial Datasets," *Proceedings of GIS/LIS 1997*, 402-404, Retrieved on 2 February 2001 from the World Wide Web. http://www.spatial.maine.edu/~onsrud/pubs/comcopyrtabstract84.htm

Prescott, J. R. V. (1985). The Maritime Political Boundaries of the World. Methuen, London, New York.

Re: Newfoundland Continental Shelf. (1984), 1 S.C.R. 86.

Reference Re: Ownership of Off Shore Mineral Rights (British Columbia). (1967), S.C.R. 792.

Rosell, S. A. (1999). *Renewing Governance: Governing by learning in the information age.* Oxford University Press.

Smith, R.W. and G. Taft, (2000). "Legal Aspects of the Continental Shelf," Chapter 3 in: *Continental Shelf Limits: The Scientific and Legal Interface*, P.J. Cook and C.M. Carleton, Eds., Oxford University Press.

Sohn, L.B. and K. Gustafson (1984), *The Law of the Sea in a Nutshell*. West Publishing Company, St. Paul Minnesota.

Sutherland, M. (2002). *A Philosophy of Marine Boundaries Facilitating Ocean Governance.* Ph.D. thesis in progress, Department of Geodesy and Geomatics Engineering, University of New Brunswick, Fredericton, Canada.

Sutherland, M. (2002). "A Classification of Canadian Marine Boundaries and the Design of a Conceptual Marine Boundary Database Framework." Contract report prepared for Fisheries and Oceans Canada (Canadian Hydrographic Services). March 2002.

Sutherland, M. (2003). The Outcomes of the UNB-FIG meeting on Marine Cadastre Issues, University of New Brunswick, Fredericton, NB, Canada.

Sutherland, M. and S. Nichols [2002]. "Design of a Marine Boundary Database Architecture for the Bay of Fundy." Contract Report for the Canadian Hydrographic Service, Ottawa, March, 2002.

Sutherland, M., S. Ng'ang'a and S. Nichols (2002). "In Search of New Brunswick's Marine Administrative Boundaries." Accepted for *Proceedings of the CIG-ISPRS Joint Symposium on Geospatial Theory, Processing and Application*, Ottawa, July 2002.

Sutherland, M.D. (2001). *Marine Boundaries in Support of Good Ocean Governance*. PhD Thesis in progress, Department of Geodesy and Geomatics Engineering, University of New Brunswick, Fredericton, Canada. *Changed to*: Sutherland M (2002). *A Philosophy of Marine Boundaries Facilitating Ocean Governance*. Ph.D. thesis in progress, Department of Geodesy and Geomatics Engineering, University of New Brunswick, Fredericton, Canada.

Symonds, Philip A. et al, (1998). "The Outer Limits of Australia's Resource Jurisdiction off Western Australia," In Purcell, PG and RR (Eds.), *The Sedimentary Basins of Western Australia*. 2. Proc Petroleum Exploration Soc. Of Australia Symp., Perth.

The Canadian Hydrographic Service (2000). *Vertical Datums and Water Levels*. Retrieved from the World Wide Web December 21, 2000. http://biachss.bur.dfo.ca/danp/datums.html

The Economist (2001). "Stop Signs on the Web." *The Economist*, Jan 13th, 2001. Retrieved on 31 January 2001 from the World Wide Web. http://www.economist.com/PrinterFriendly.cfm?Story_ID=471742

Titus, J.G. and V.K. Narayanan (1995). *The Probability of Sea Level Rise*. U.S. Environmental Protection Agency Washington, D.C. Retrieved from the World Wide Web on December 20, 2000. http://www.gcrio.org/EPA/sealevel/abstract.txt

Treaty Doc. 103-39, 103rd Congress, 2d Session, Senate, Message From the President of the United States, U.S. Government Printing Office, Washington, 1994.

U.S. Marine Cadastre website. Retrieved on April 20, 2001 from the World Wide Web. http://www.csc.noaa.gov/mbwg/htm/cadastre.htm

United Nations, Division for Ocean Affairs and the Law of the Sea, *The Law of the Sea: Definition of the Continental Shelf*, (New York, UN Sales No. E.93.V.16, 1993).

van de Poll, R., M. Halim, M. D'Arcy, J. Harding, R. Macnab, and D. Monahan (1999). Integrated Procedures for Determining the Outer Limit of the Juridical Continental Shelf Beyond 2000 Nautical Miles. In Proceedings of the International Conference on Technical Aspects of Maritime Boundary Delineation and Delimitation, International Hydrographic Bureau, Monaco, September 8-9, pp 235-246.

Vanicek, P. and E.J. Krakiwsky (1982). *Geodesy: The Concepts*. North Holland Publishing Company, Amsterdam.

Wells, D. (1997). Lecture Notes for Hydrographic Surveying. Department of Geodesy and Geomatics Engineering, University of New Brunswick, Fredericton, Canada, pp15-17.

Widodo, M. S. (2003). *The Needs for Marine Cadastre and Supports of Spatial Data Infrastructures in Marine Environment – A Case Study*. In Proceedings of FIG Working Week 2003, Ecole National de Sciences Géographiques (ENSG) and IGN Marne la Vallée, Paris, April 13–17, 2003. Retrieved from the World Wide Web October, 2003. http://www.fig.net/figtree/pub/fig_2003/TS_20/TS20_3_Widodo.pdf

Wilkins, K., M. Sutherland, S. Nichols and G. Paquet (2001). Ocean Governance: Geomatics as a Technology of Collaboration. Presented at GEOIDE conference, 2001, Fredericton, NB, Canada, June 21-22.

Williamson, I. (2003). *The Cadastral Concept.* Land Administration 451-418/607 Lecture 4, 2003, PowerPoint Presentation. Retrieved from the World Wide Web October, 2003. http://216.239.41.104/search?q=cache:94F7PlBEYAwJ:www.sli.unimelb.edu.au/subjects/451/418/Lecture%25204%2520-%2520Cadastral%2520Concept%2520-%25202003.ppt+definition+of+a+cadastre+McLaughlin&hl=en&ie=UTF-8

Williamson, I.P., Leach, J. and Rajabifard, A. (2001) *Marine Cadastres*. Position paper submitted to 7th Meeting of the Permanent Committee on GIS Infrastructure for Asia and the Pacific (PCGIAP), Tsukuba, Japan.

Written Statement by the Delegation of Canada Dated 2 April 1980, UN Doc. A/Conf. 62/WS/4 United Nations, Third Conference on the Law of the Sea, Ninth Session, New York.

CURRICULUM VITAE

Sara Patricia Cockburn

Universities Attended:

A.B., Bowdoin College, 1996
J.D., Tulane University School of Law, 1999

Publications:

Cockburn, S., L. Pontes, S. Thériault, and P. Butler (2004). "A Coastal Zone Disaster Management Decision Support System Using HPD: A Tripartite Solution." In *Proceedings of the International Hydrographic Seminar Hydro Ind 2004: "Marine Surveys for National Security and Development."* Presented in Mumbai, March 26 and 27, 2004.

Ng'ang'a, S., M. Sutherland, S. Cockburn, and S. Nichols (2004). "Toward a 3D Marine Cadastre in Support of Good Ocean Governance: A Review of the Technical Framework Requirements." In *Computers, Environment and Urban Systems (CEUS)*, Volume 28, Issue 5, September 2004, Pages 443-470, Cadastral Systems III.

Cockburn, S., S. Nichols, and D. Monahan (2003). "UNCLOS' Potential Influence on a Marine Cadastre: Depth, Breadth, and Sovereign Rights." In *Proceedings of the Advisory Board on the Law of the Sea to the International Hydrographic Organization (ABLOS) Conference "Addressing Difficult Issues in UNCLOS."* Presented at the International Hydrographic Bureau, Monaco, October 2003. http://www.gmat.unsw.edu.au/ablos/ABLOS03Folder/PAPER1-1.PDF

Cockburn, S. and S. Nichols (2002). "Effects of the Law on the Marine Cadastre: Title, Administration, Jurisdiction, and Canada's Outer Limit." In *Proceedings of the XXII FIG International Congress, 2002.* Presented at the XXII FIG International Congress, Washington DC, USA, April 24, 2002. http://www.fig.net/figtree/pub/fig_2002/Js12/JS12_cockburn_nichols.pdf

Cockburn, S. and S. Nichols (2002). "When is a Boundary Not Really a Boundary? Some Reflections on Offshore Administrative Limits in Eastern Canada Based on the Recent Arbitration Between Newfoundland and Nova Scotia." In *The Ontario Land Surveyor*, Vol. 45, No. 2* Summer 2002.

Cockburn, S. and S. Nichols (2002). "General Principles of Marine Boundary Delimitation: Equidistance, Equity, and Special Circumstances." Contract report for Service New Brunswick, Fredericton, New Brunswick, November 2002.

Cockburn, S. and S. Nichols (2002). "Marine Rights of the Provinces: A Constitutional Perspective and an Examination of New Brunswick's Water Boundaries." Contract report for Service New Brunswick, Fredericton, New Brunswick, November 2002.

Cockburn, S. and S. Nichols (2002). "Factors in Inter-provincial Boundary Delimitation: Points of Interest for Surveyors in the Newfoundland & Labrador/Nova Scotia Boundary Arbitration." Contract report for Service New Brunswick, Fredericton, New Brunswick, November 2002.

Cockburn, S., S. Nichols, and A. LaForest (2001). "Offshore Boundaries: Federal/State and Inter-State Maritime Boundaries in Federations - a Comparative Study." Contract report for Service New Brunswick, Fredericton, New Brunswick, February 2001.

Cockburn, S., S. Nichols, D. Monahan and T. McDorman (2001). "Intertwined Uncertainties: Policy and Technology on the Juridical Continental Shelf." In *Proceedings of the Advisory Board on the Law of the Sea to the International Hydrographic Organization (ABLOS) Conference "Accuracies and Uncertainties in Maritime Boundaries and Outer Limits."* Presented at the International Hydrographic Bureau, Monaco, October 2001. http://www.gmat.unsw.edu.au/ablos/COCKBURN.PDF

Monahan, David, Susan Nichols, Edward Byrne, R. Castonguay, Sara Cockburn, M. D'Arcy, Larry Felt, Roger Guadet, John Hughes Clarke, Maria Innes-Buzeta, Anne LaForest, Wade Locke, Ted McDorman, Sam Ng'ang'a, Gilles Paquet, Rob van der Poll, Michael Sutherland, Dave Wells and Kevin Wilkins (2001). "The Contribution of Digital Boundary Information to Good Governance for Improved Decision-Making." The 2nd International Conference On Digital Earth, Fredericton, NB, Canada. Paper Number DE-A-86. 24-28 June 2001. http://www.digitalearth.ca/abstract2.html#de-a-086

Nichols, S., J. Dobbin, S. Ng'ang'a, S. Cockburn, M. Sutherland, K. Cove, and T. Beran (2001). "Roles and Responsibilities for Surveying in Offshore Canada Lands." Contract report prepared for Natural Resources Canada, Legal Surveys Division, September 2001.

Ng'ang'a S. M., S. Nichols, M. Sutherland and S. Cockburn (2001). "Towards a Multidimensional Marine Cadastre in Support of Good Ocean Governance: New Spatial Information Management Tools and Their Role in Natural Resource

Management." Paper #TS 12.3, in *Proceedings of the International Conference on Spatial Information for Sustainable Development*, ISK, FIG, and UN Habitat, Nairobi, Kenya, 2-5 October 2001. http://www.ddl.org/figtree/pub/proceedings/nairobi/nganga-nichols-sutherland-cockburn-TS12-3.pdf

Conference Presentations:

Cockburn, S., S. Nichols, and D. Monahan (2003). "A Tool for the Spatial/Legal Framework of Managing Activities in the Oceans and Coastal Zones: the Marine Cadastre." Presented at the Ocean Management Research Network (OMRN) National Conference "*Canada's Oceans: Research, Management and the Human Dimension."* P. 44. Presented at the Government Conference Centre, Ottawa, Ontario**,** November 2003.

Cockburn, S. (2002). "Sink or Swim: Building Resource Management Capacity Through Resource Claim Analysis" Presented at the Ocean Management Research Network International Conference "*Canada's Oceans: Research, Management and the Human Dimension."* October 25-27, 2002. http://www.omrn.ca/con_abstracts.pdf

Ng'ang'a, S., M. Sutherland, S. Cockburn and S. Nichols (2001). "Toward a 3D Marine Cadastre in Support of Good Ocean Governance." Presented at *Registration of Properties in Strata*, International Workshop on 3D Cadastres, Delft, Netherlands, 28-30 November 2001.

Sutherland, M., S. Cockburn, and A. LaForest (2001). "Administrative Boundaries and the Role of Geomatics." Presented at the GEOIDE Conference 2001, Fredericton, New Brunswick, Canada, June 21-22, 2001.