

Characteristics of Marine Boundaries and Marine Boundary Information Required to Support Canadian Coastal and Marine Governance

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Key words:

SUMMARY

Marine boundaries can be categorized as environmental or human-interactive. Environmental boundaries are biological, ecological etc. in nature and are not part of the focus of this paper. Human-interactive boundaries are so described because human consciousness of them serves as frameworks for interaction with either the environment or other humans. Marine boundaries can also be classified according to the rights associated with the spatial extents enclosed by the boundaries. These rights include sovereign, jurisdictional, administrative, private, customary and aboriginal rights. In Canada these boundaries occur within the framework of legislation, common law, memoranda of understandings, Accords, traditions and cultural heritage that each defines the nature of human interaction with one another and with the spatial extent delimited by the boundaries. This paper will examine, from a Canadian perspective, the characteristics of marine boundaries and marine boundary information required to support coastal and marine governance with respect to the aforementioned rights.

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1. INTRODUCTION

It is accepted herein that socio-cultural, economic and political requirements comprise the totality of governance requirements for a jurisdiction. The focus of this paper is primarily Canada, but the requirements presented in this paper are expected to be flexible enough to be applicable to other international jurisdictions. There are two main questions of concern:

1. What characteristics of marine boundaries are required to give adequate support to the good governance of marine spaces?
2. What qualities and characteristics of marine boundary information are required to adequately support the good governance of marine spaces?

The approach to answering the questions is from a functional perspective, i.e. from the perspective of why stakeholders in the governance of marine spaces do what they do, what tasks they perform, and consequently what is required of marine boundaries and marine boundary information for them to do those tasks to the benefit of good governance. This paper will present, individually and in separate sections, discussions on boundary requirements and boundary information requirements relevant to the governance objectives in marine spaces (i.e. the political, economic, socio-cultural and environmental objectives).

2. MARINE BOUNDARY REQUIREMENTS FOR GOVERNANCE OBJECTIVES IN MARINE SPACES

Government is the most pervasive player in governance [Stanbury, 1993; Savoie, 1993; Paquet, 1999; Tims, 2000; Spicer, 2000; Sutherland, 2003]. As such, government has certain requirements (comprising sovereign, jurisdictional and administrative components) that include:

- a. The security of its sovereign boundaries and the settlement of disputes over territorial marine spaces
- b. The maintenance of socio-economic and political relations with other states including:
 - The control of cross-border trading in goods and services
 - The application of custom duties and trading agreements
 - The application of diplomatic immunity
 - The application of immigration rules and regulations
- c. The enforcement of its jurisdictional powers
- d. The enforcement of laws and policies to facilitate economic and socio-cultural activities, and the management and protection of its marine natural resources

- e. The exercise of its administrative powers and the delivery of appropriate services to its citizens in order to facilitate economic and socio-cultural activities, and the management and protection of its marine natural resources.

Although the social, economic, and political sectors impact upon one another all activities require political sanction, at least in Western societies. The polity is even an integral part of environmental protection through the implementation of laws and policies. Therefore the discussions in this paper on boundary, and boundary information, requirements will be presented from the perspective of governments' facilitation of political, socio-cultural, economic, and environmental management activities.

2.1 Marine Boundary Requirements for the Protection of Sovereign Boundaries

To varying degrees in terms of the vertical dimensions of the water column, Canada has sovereign rights to the outer limits of the continental shelf [Oceans Act, 1996]. Protecting these sovereign marine boundaries require knowledge of their positions in the marine environment. Determining the positions of these limits also depend on knowledge of the positions representing the intersection of low water with the coast (as prescribed by the *Oceans Act* [1996]). International bilateral boundaries are also sovereign boundaries. Canada shares ocean spaces with other countries by means of international bilateral boundaries with such countries as the U.S., Denmark and France. In the case of these boundaries there is the requirement to have agreement on the position of the boundaries by the parties involved. Positional accuracy with relation to international bilateral boundaries may be desirable for the governance of international waters but there are instances where countries have peaceably coexisted without international marine boundaries being accurately defined. For instance Canada and the U.S. both claim Machias Seal Island and to date the boundary between the two countries in this area has been left undefined without any real ill effect upon the relationship between the two States [Gulf of Maine times, 1997].

The adequacy of baseline definitions might not apply to international bilateral boundaries in some instances. However, the adequacy of datum definitions for the locating of datum intersections with the coastlines of the States, and up-to-date surveys of coastlines involved are very important if the bilateral boundary is the result of calculations from opposite coastlines. Additionally, in the deep offshore, the most practical method of delimiting a boundary is by way of coordinates. The use of coordinates to define marine boundaries is therefore also a requirement.

2.2 Marine Boundary Requirements to Support International Political and Socio-Economic Relationships

The maintenance of socio-economic relations with other sovereign States is an important political task. These relationships are important both to the polity (for example to support socio-economic activities abroad and to receive the goods and services it needs to carry out its duties)

and to the citizens of a State as they pursue their socio-economic activities. The polity also has the responsibility to protect the socio-economic welfare of its citizens and does this by (among other things):

- a. The control of cross-border trading in goods and services
- b. The application of custom duties and trading agreements
- c. The application of immigration rules and regulations

The items listed above and those implied by the discussion in the previous paragraph have responsibilities impacting upon sovereignty, jurisdiction, and administration. Also because some of the activities listed above relate to the transportation of people, goods, and services across the marine environment navigation is affected. In Canada the relevant responsibilities fall to the Federal government and their agencies. The control of cross-border trading in goods and services, the application of custom duties and trading agreements, and the application of immigration rules and regulations require that the position of international boundaries and custom limits be ideally known to some degree of accuracy. The application of jurisdictional rules and regulations, and administrative responsibilities also require that the relevant boundaries reflect certainty of legal definitions and conform to legal definitions to ensure that States are not contravening the rights of persons. In order to avoid hazards to navigation the relevant boundaries such as those relating to shipping lanes or routing measures have to be fairly accurate. The arguments in the previous section relating to defining the boundaries by coordinates also apply.

2.3 Marine Boundary Requirements to Support the Enforcement of Jurisdictional Powers

In Canada, which is a Federal State, jurisdiction has federal and provincial dimensions. Federal-Provincial jurisdiction has been a historical issue, especially in the marine environment [La Forest, 1973; Lamden and de Rijcke, 1996; Nichols and Monahan, 1999]. Supporting this point, Jackson [1976] wrote: “The question of jurisdiction — competing, conflicting, concurrent or obscure — runs as a thread through Canadian history since 1867” and also “the question of jurisdiction is something of a Canadian obsession, probably much more than the United States, though possibly not more so than in Australia.”

The question of which entity, Federal or Provincial, has jurisdiction over particular spatial extents is directly tied to marine boundaries. However in Canada the issue of who has jurisdiction over certain marine spatial extents has to date remained a matter of jurisdictional uncertainty. Fortunately the long tradition of Federal-Provincial “accommodation and compromise” [Jackson, 1976] has been the catalyst for amicable solutions. This is an example of collaborative and cooperative governance and can be used to support the argument that precise boundaries are not always necessary to meet governance objectives.

The issues related to Federal or Provincial jurisdiction over Canadian marine spaces, and by implication the relevant marine boundaries, is affected by the common law, the Canadian Constitution, the definition of what are Canada Lands, and the history of Canadian Federation [*The Constitution Act*, 1876; *Canada Lands Surveys Act*, 1985; *Oceans Act*, 1996; La Forest, 1959; Nichols, Dobbin, Sutherland et al, 2001]. The Constitution prescribes certain “Classes of Subjects” [*The Constitution Act*, 1876] over which the Federal and Provincial Crowns can make laws and have jurisdiction, but at the time of drafting the issue of submerged lands offshore was not perceived [Raymond, 2002]. The *Canada Lands Surveys Act* [1985] defines “Canada Lands”, which falls under federal jurisdiction, but the definition is vague in terms of where Canada Lands begin on the coast in terms of the land-sea intersection.

The common law tradition holds that provincial jurisdiction/ownership applies to land between the OHWM and low water except if expressly transferred to the Federal Crown (e.g. public harbours) [La Forest, 1973] but certain provinces, e.g. New Brunswick, claim jurisdiction over submerged lands below low water by virtue of historical rights before confederation. Even after deliberating the merits of the constitution and the common law, eminent legal thinkers like La Forest [1973] concluded that the “ownership of the subsoil of the territorial sea off the Atlantic Provinces cannot ... be regarded as settled.” However, as previously alluded to, Canada has been able to overcome the immediate problems related to Federal-Provincial jurisdiction via, for example, royalty agreements, and accords whereby provinces govern specific activities (e.g. aquaculture) through administrative powers divested to them from the Federal Crown [Nichols and Monahan, 1999; Jackson 1976]

Apart from the legal definition of where federal or provincial jurisdiction spatially commences or ends (or in other words where federal or provincial boundaries are physically located in terms of the legal definitions of the boundaries), there are also the technical problems associated with the physical location of jurisdictional boundaries. Even if legal definitions of jurisdictions have been proffered, the term “high water” or “low water” is too imprecise a definition to locate the physical position of coastal boundaries. One may ask: which “high water?” or “which low water?” In other words, which level of the sea surface, or which tidal datum should be used to locate the land-water intersection that will represent the physical location of the boundary along coastlines? Additionally, the dynamic nature of the coastal environment means that even if a precise tidal datum is specified the position of the boundary defined thereby will change over time [Flushman, 2002; Reed, 2000; Lamden and de Ricjke, 1996; Nichols, 1983]. Coastal boundaries will have to be resurveyed periodically in order to relocate the boundaries and to keep the boundary information up-to-date. Considering the length of Canada’s coastline this is a very expensive task. In the deep offshore, the previous arguments relating to the definition of boundaries by coordinates still apply.

Some of the requirements discussed above are only ‘desirable’ because although the particular boundary requirements in question might be an improvement, many of these boundaries exist and basically provide the functions for which they were designed without too much adverse

effect on their contribution to the good governance of marine spaces. It is to be understood that a delimited boundary may serve more than one purpose depending on the perspective of the party relating to it. A boundary might be a jurisdictional boundary to a jurisdictional authority and at the same time functions as administrative boundary to another entity. Still to another entity the same boundary marks the limit of private rights.

2.4 Marine Boundary Requirements to Support the Enforcement of Laws and Policies

Government uses laws and the implementation of appropriate policies as one means of facilitating the socio-cultural and economic objectives of its citizens. Attempts at protecting the natural resources within a jurisdiction are also facilitated by these means. Laws and policies provide the necessary frameworks for the actions of citizens as they relate to one another and to the natural environment, terrestrial or marine.

As is to be expected the marine environment is the focus of this paper. It is not within the scope of this work to examine all laws and policies relating to the marine environment. The focus will be on certain CZM and marine policies that will serve as the basis for examples of, and underscore certain points in relation to, marine boundary requirements to support the enforcement of policies in the governance of marine spaces.

In the Canadian marine environment there are many varying and overlapping rights, and hence many varying and overlapping boundaries to manage. These rights and boundaries reflect the many and varying objectives competing for use of marine spaces, i.e. economic, social, cultural, and political objectives. The laws and policies are created to manage the behaviors of citizens, reasonably facilitate their objectives, and at the same time manage access to, and impact upon, the marine resources that are required to meet the various objectives [Paquet, 1999; Harmon, 1995; Doern, 1988]. Therefore laws and policies tend to target maximum spatial extents within which many stakeholders compete for use of and access to marine resources.

The effectiveness of the laws and policies are in part dependent upon the marine boundaries enclosing the spatial extents that are targeted by the laws or policies. As with the discussions in the previous sections in this paper, the arguments in relation to the marine boundaries in terms of certainty of legal definition and conformity to legal definitions hold. To effect enforcement of marine laws and policies also requires accuracy of the boundary position and the dissemination of that knowledge to the enforcers, as well as to the other stakeholders affected by the laws and policies. Since many of the marine boundaries affected by laws and policies are coastal boundaries, the arguments proffered earlier regarding tidal datums and the dynamic nature of coastlines are also relevant. Sutherland and Nichols [2002] outline a case that demonstrated the fact that the objective of a policy to protect marine resources might be undermined by the placement of its outer boundary. Therefore the appropriateness of boundary location to achieve targeted objectives is also a boundary requirement to support the enforcement of laws and policies.

2.5 Marine Boundary Requirements to Support the Exercise of Administrative Powers and the Delivery of Services

Administrative services are based upon implemented laws and policies that combine with regulations, organizational structures, information systems, information, information infrastructures, and human resources to effect operational aspects of governance. Administrative services provide a more direct interface between government and citizens for the necessary exchange of information for all stakeholders to pursue their objectives. This is true in relation to both the terrestrial and marine environments.

The management of all types of information, including marine boundary information, necessary to support socio-cultural and economic activities, and to manage access to natural resources is very important at the administrative level of governance. The management of information facilitates the allocation of marine resources via the management of rights to marine spatial extents. Marine administrative boundaries enclose spatial extents within which particular rights are allocated, either to the complete spatial extent or to some portion thereof. In this regard marine administrative boundaries are important components of the good governance of marine spaces [Nichols and Monahan, 1999, Nichols, Monahan and Sutherland, 2000].

From the perspective of Canadian government administration of marine resources there are two levels of governance: federal and provincial. Federal administrative marine authorities are intrinsically tied to federal jurisdictional authorities, while provincial administrative authorities are tied to either federal or provincial marine authorities, depending on the circumstances. In Canadian law, federal authorities have jurisdiction and administrative authority over marine activities such as offshore oil and gas operations in submerged lands understood to be Canada Lands. The Federal Crown also administers rights in trust for the 'public' and therefore has jurisdiction and administrative authority over activities dealing with navigation etc. Federal administrative authority extends seaward to the outer limits of its jurisdiction [*Oceans Act*, 1996; United Nations, 1997 and 1999; Sohn and Gustafson, 1984].

In those marine areas where there are not uncertainties over federal and provincial jurisdiction or title, provincial administrative authority is in effect. In other areas the Canadian Federal Crown has transferred administrative authority to the provinces in relation to specific activities such as aquaculture, or to benefit from oil and gas exploration and operations [Wildsmith, 1982; Nichols, Edwards et al, 1997; e.g. *Canada-New Brunswick Memorandum of Understanding on Aquaculture Development*, 1989].

Marine administrative boundaries (federal or provincial) are subsets of jurisdictional boundaries and therefore face the same requirements as put forward in Section 2.3. Also depending on what is being administered, for example oil and gas rights or the protection of an environmentally sensitive area, the appropriateness of boundary locations is also a requirement.

2.6 Marine Boundary Requirements for Private, Customary, and Aboriginal Marine Rights

From a boundary point of view, facilitating the socio-cultural and economic objectives of Canadian citizens in marine spaces translates to the management of private, customary (or traditional), and aboriginal rights to marine spaces. These rights are subject to many federal and provincial legislation¹ and laws. The spatial extents, and hence the boundaries, of all these rights are located within the bounds of both federal and provincial jurisdictional and administrative areas.

There are many private rights administered by the Federal Government. These include rights related to (among possibly others):

- a. Leases, safety zones, and development areas related to oil and gas exploration and production
- b. Leases for offshore mineral rights
- c. Leased areas for other industrial and commercial works
- d. Disposal areas for chemical and other hazardous substances
- e. Leased and purchased areas for private marine parks and the protection of wildlife
- f. Federal fishing licence areas
- g. Leased fishing and recreational harbors
- h. Federal marine real property grants and concessions

The survey of boundaries related to private rights administered by the Federal Crown is the responsibility of the Surveyor General of Canada, and the survey tasks are executed by Canada Lands Surveyors [*Canada Lands Surveys Act*, 1985; *Canada Lands Surveyors Act*, 1998]. According to Section 27 of the *Canada Lands Surveys Act* [1985] “The Minister may direct that Canada Lands be surveyed, laid out and defined in any manner, by any method of surveying and with any description that the Minister considers desirable in the circumstances affecting those lands.” Discussions with representatives of the Surveyor General for Canada disclosed that surveys are however done to certain standards.

Since the NAD83 (CSRS) datum is now the Canadian federal standard, the coordinates of previously issued offshore right that were referenced to other datums are now being transformed to NAD83 (CSRS). Coordinate shifts resulting from the transformations have prompted the Surveyor General to investigate appropriate strategies to determine how the definition of the spatial extents of the affected rights will be addressed [Nichols, S., J. Dobbin, M. Sutherland et al, 2001]. Discussions with representatives of the Surveyor General for Canada and statistical surveys completed by representatives of the oil and gas industry, and offshore fishermen suggest that accuracy of boundary positions is important to the Federal Government and their clients

¹ The appropriate legislation governing these rights are listed among the references

[Gagnon, 2002; Byrne, 2002; Noël, 2002]. The lack of fine precision in locating marine boundaries does not seem to be a hindrance to their marine governance activities.

Private offshore rights that are administered by the provinces are mainly related to aquaculture and other forms of sea ranching, and water lots [Nichols, Edwards et al, 1997]. Statistical surveys completed by provincial administrators interested in private rights offshore indicated that while accuracy of boundary location is important to them, accuracy of 1 metre from the true position is sufficient for their needs [Finley, 2002; Light, 2002]. The lack of finer precision is therefore not a hindrance to their marine governance operations.

At least in New Brunswick aquaculture sites (and possibly other kinds of marine private rights) have been subject to demarcation by buoys tied to concrete blocks placed on the seabed in the Bay of Fundy. This is possible in instances where the farm site is located close to shore in reasonably shallow water. The practicality of using buoys to demarcate the corners of marine spatial extents has limitations on precision because of a number of reasons, especially in the Bay of Fundy that has the highest tide differential in the world. First, buoys are subject to circular movements caused by tidal actions and therefore it is difficult, if not impossible, to precisely mark the corner of rights. Second, tidal movements have been known to cause the relocation of the concrete blocks many metres from the true position of the boundary. In the case of salmon cages, tidal actions have been reported to also move aquaculture equipment, including the cages, to many metres outside of the spatial extents within which the aquaculture farms have been allocated the right to operate.

There are traditional fishing rights that exist near the coasts of provinces. To the author's knowledge, provincial authorities may recognize traditional rights but there may not be formal information on the boundaries, or boundary surveys that is maintained by provincial administrative authorities. The author is not aware of any legislation dealing with traditional fishing (or other) rights in the marine environment, and the general understanding is that these rights have accrued under the common law by continued use of marine spaces.

Aboriginal rights in the offshore have in recent times become very important. It is absolutely plausible that Aboriginal groups have rights to portions of Canada's submerged lands [McNeil, 2001; Muir, 1999; Nichols, Edwards, Dobbin et al, 1997] The problem is that the rights and the limits of these rights in many instances remain undefined, or are not clearly defined resulting in sometimes violent disputes between citizens and aboriginal groups, and between federal authorities and aboriginal groups. The Marshall Case² is just one of many instances of litigation resulting from this lack of clarity. It is desirable by federal authorities monitoring and managing marine resources to have the spatial limits of Aboriginal marine rights accurately positioned, but discussions with some members of the Mi'kmaq First Nations Band in New Brunswick suggest

² R.v. Marshall [1999] 3 S.C.R. 0456.

See http://www.lexum.umontreal.ca/csc-scc/en/pub/1999/vol3/html/1999scr3_0456.html

that the Band is not keen to have those spatial limits located accurately or precisely as they fear losing rights to spatial extents in which they might have rights and interests according to their traditions and cultures.

3. MARINE BOUNDARY INFORMATION REQUIREMENTS FOR GOVERNANCE OBJECTIVES IN MARINE SPACES

While the existence of marine boundaries is important to the governance of marine spaces by facilitating the allocation of marine resources, if information about the boundaries is not communicated to those who make decisions about the governance of marine spaces, or utilize marine spaces to pursue socio-cultural, economic, political, and environmental management objectives, then good governance will be undermined. Boundary information is at least physical, graphical and textual in nature. Physical information relates to physical markers in the environment where the boundary exists that give cues to the existence of the boundary. Graphical boundary information is multi-dimensional graphical information displayed on analog or digital maps, plans and charts. Textual boundary information includes legible descriptions of the boundary itself, and attributes associated with the boundary (e.g. ownership, type of boundary, metadata etc.). Governance is about decision-making and this requires access to boundary information that is [Federal Geographic Data Committee, 2002c; Struck and Dilks, 1998; Altheide, 1998; Aronoff; 1993]:

- a. Up-to-date
- b. Accurate (in terms of both position and attributes)
- c. Logically consistent
- d. Complete
- e. Useful

Marine boundary information that is up-to-date is ideally reflective of the most recent acquisition of boundary information, and in addition that information also models the current physical, legal, mathematical etc. status of the boundary being represented. This is essential especially in relation to boundaries along coasts that are subject to change in positions in tandem with physical coastal changes. It may not be critical to governance if boundary information reflects slight disparities with the true position of the boundary, depending on the use of the information. If however planning or other decisions are being based on features or dimensions in the model it is more than desirable for the information to be up-to-date as defined above. Accuracy of information is implied.

Boundary information accuracy refers to the correctness of information in terms of both the graphical representation of the boundary's position in multi-dimensional space, as well as the correctness of the boundary's descriptive themes [Struck and Dilks, 1998; Altheide, 1998; Aronoff; 1993]. Thematic accuracy means that information on coordinates, ownership,

classification, associated laws, associated rights etc. is correct. However, if the graphical and attribute information reflects verbatim the boundary as located 'on ground,' but the boundary itself is incorrectly positioned, or does not reflect the legal definition of the boundary then the information is still inaccurate. Therefore boundary information accuracy must include a reflection of the legal definition of the boundary. This legal definition can be as a result of common law, customary practice, or legislation and regulations. The accuracy of marine boundaries must also include a more faithful representation of the multi-dimensional nature of the rights existing in marine spaces.

Boundary information is also required, or at least desired, to be logically consistent [Aronoff; 1993]. Logical inconsistency can occur, for instance, when coastlines are mapped in part and at different times. Due to the dynamic nature of coastlines and tidal variations the ordinary high water mark (OHWM), for instance, may not occur at the same location in time and space and mapping a particular stretch of coast in parts and at different times can produce OHWM positions for different instances in time [Nichols, 1983]. The data would therefore be logically inconsistent if the results of the various mapping exercises are combined. Logical consistency implies an aspect of accuracy.

Boundary information is also required to be complete [Aronoff, 1993]. The term 'complete' has multiple dimensions. Information on all the mathematical and physical dimensions of the boundary is required to fulfill the requirement of completion (i.e. all of the boundary is represented graphically or described textually). Boundary information is also required to be thematically complete. Thematically, complete boundary information implies the availability of all needed descriptive information. If thematic information from certain sources is available, up-to-date and accurate, but there are other sources that maintain other needed thematic information associated with the boundary and those information are unavailable, then the information at hand is incomplete, depending on what decisions need to be made. In many instance, therefore, complete information is dependent upon stakeholder cooperation, collaboration, integration etc. Complete information that is inaccurate or out of date is a hindrance to good governance because of the possibility of supporting faulty decision-making.

The usefulness of boundary information also has many dimensions. First the information has to be accessible to appropriate stakeholders to be useful. A number of factors impact upon accessibility. The mandate of stakeholders who maintain boundary information must allow for other stakeholders to have access. Shared mental maps of stakeholders' objectives in the marine environment, the willingness to share information, appropriate organizational structures to facilitate the sharing of information, qualified human resources to manipulate the information, affordable access mechanisms, appropriate geographic information technologies, efficient database management systems, and efficient data infrastructures are all required to facilitate access to up-to-date, accurate and complete information. Data standards and metadata also contribute to usefulness. Reliable output in the form of analog or digital maps and charts at appropriate scales, referenced to useful datums, and having boundary and other spatial

information displayed in useful formats (e.g. vector, raster, multibeam etc.) is also a necessity depending on the use of the information (e.g. tenure management, resource management etc.).

4. SUMMARY AND CONCLUSIONS

This paper addressed two main questions. The first question is: What characteristics of marine boundaries are required to give adequate support to the good governance of marine spaces? In order to answer this question the discussions were made from the perspective of politics since government is the facilitator of socio-cultural and economic activities, and a significant player in (as well as facilitator of) the management of marine resources through laws and policies. The second question is: What qualities and characteristics of marine boundary information are required to adequately support the good governance of marine spaces?

The first question was addressed through the presentation of a series of boundary requirements depending on the class of governance activities being engaged in. A number of points were brought out in the discussions, including (among other things).

- a. There are a number of marine boundaries with varying degrees of sovereign rights attached to them
- b. The most practical method of delimiting a marine boundary in the deep sea is by way of coordinates
- c. The use of buoys to demarcate the corners of rights to marine spatial extents in shallower waters has been done but tidal actions affect accuracy and precision of their positioning
- d. The issues related to Federal or Provincial jurisdiction over Canadian marine spaces, and by implication the relevant marine boundaries, is affected by the common law, the Canadian Constitution, the definition of what are Canada Lands, and the history of Canadian Federation
- e. Certain boundary requirements are desirable but their absence may not significantly and negatively affect the governance of marine spaces
- f. Marine boundaries can have multiple functions
- g. There are a number of boundary requirements necessary for the good governance of Canadian marine spaces depending on the type of boundary, and function of the boundary, including:
 - Certainty of legal definition
 - Conformity to legal definition
 - Agreement by parties to the boundary
 - Definition by coordinates where appropriate
 - Demarcation by buoys where appropriate
 - Adequacy of baseline definitions
 - Adequacy of tidal (and other) datum definitions

- Up-to-date coastline surveys
- Accuracy of positioning
- Appropriateness of boundary location

The second question was addressed by examining marine boundary information from the perspective of data and information quality as applied to any other category of information. Although much of the information in this section is not new in terms of what is required of data quality in general, the discussions on boundary requirements to support the good governance of marine spaces would be incomplete without this examination. A number of points were brought out in the discussions, including:

- a. Desirable marine boundary information is up-to-date, accurate, complete, and useful
- b. Information can be up-to-date but not accurate, logically consistent complete or useful
- c. Information can be accurate but not complete or useful
- d. Information can be complete but not accurate, up-to-date or useful
- e. Usefulness of information depends upon a number of factors including:
 - Accuracy, currency, and completeness of the information
 - Stakeholder access to the information, facilitated by:
 - Shared mental maps of stakeholders' objectives in the marine environment
 - The willingness to share information
 - Appropriate organizational structures to facilitate the sharing of information
 - Qualified human resources to manipulate the information
 - Affordable data access mechanisms
 - Appropriate geographic information and other technologies
 - Efficient database management systems
 - Efficient spatial data infrastructures
 - The existence and application of data standards and metadata
 - Reliable output formats and appropriate scales for the intended use of the information

REFERENCES

- Altheide, P. (1998). "Spatial data transfer standards." *In GIS Data Conversion: Strategies • Techniques • Management*, Hohl, P. (Ed.), Onward Press
- Aronoff, S. (1993). *Geographic Information Systems: A Management Perspective*. 3rd. Edition, WDL Publications, Ottawa.
- Byrne, Pat (2002). Personal communication. Frugro GeoSurveys Inc., St. John's, Newfoundland, Canada.
- Craymer, M., R. Ferland and R. Snay (1999). "Realization and Unification of NAD83 in Canada and the U.S. via the ITRF." <http://www2.geod.nrcan.gc.ca/~craymer/nets/nad83csrs/nad83csrs.html>, accessed August 2002.
- Doern, G. B. and R. W. Phidd (1988). *Canadian Public Policy, Ideas, Structure, Process*. Methven, Toronto.

- Federal Geographic Data Committee (FGDC) (2002). "Content Standard for Digital Geospatial Metadata Workbook, version 2." Federal Geographic Data Committee (FGDC), National Ocean and Atmospheric Association (NOAA).
- Finley, D. (2002). Personal communication: Survey response. Service New Brunswick, Fredericton, Canada.
- Flushman, B. S. (2002). *Water Boundaries: Demystifying Land Boundaries Adjacent to tidal or Navigable Waters*. Wiley Series in Surveying and Boundary Control.
- Gagnon, Jean (2002). Personal communication. Canada Lands surveyor, Natural Resources Canada, Legal surveys Division.
- Gulf of Maine Times (1997). "Machias Seal Island: US and Canada collaborate on bird sanctuary management despite sovereignty dispute" <http://www.gulfofmaine.org/times/summer97/page1a.html>, accessed August 2002.
- Harmon, M. M. (1995). *Responsibility as Paradox: A critique of rational discourse on government*. SAGE Publications, Thousand Oaks • London • New Delhi.
- Jackson, C. I. (1976). "Policy planning in the Government of Canada." In *Spatial Dimensions of Public Policy*, Eds. Coppock, J. T. and W. R. D. Sewell. Pergamon Press, Oxford • New York • Toronto • Sydney • Paris • Frankfurt.
- La Forest G V (1959) Report on the rights of the provinces of Nova Scotia, New Brunswick and Prince Edward Island to the ownership of adjacent submarine resources. Faculty of Law of the University of New Brunswick.
- La Forest, G. V. (1973). "Coastal waters at Common Law." In *Water Law in Canada - The Atlantic Provinces*. Atlantic Development Board.
- Lamden, D. and I. de Rijcke (1996). *Legal Aspects of Surveying Water Boundaries*. Carswell ; Association of Ontario Land Surveyors.
- Light, E. (2002). Personal communication: Survey response. Geographic Information Services, Registry and Information Management Services Division, Service Nova Scotia and Municipal Relations, Halifax, Canada.
- McNeil, K. (2001). "Aboriginal rights in transition: Reassessing Aboriginal title and governance." In *The American Review of Canadian Studies*, Volume 31, Numbers 1 & 2, Spring and Summer 2001, pp. 316-329.
- Monahan, D., S. Ng'ang'a, S. Nichols and R. van de Poll [1999]. "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." Published in the proceedings of the International Conference on Accuracies and Uncertainties in Maritime Boundaries and Outer Limits, Monaco, France, October.
- Muir, M. A. K. (1999). *Contrasting Approaches to Aboriginal Water Management: Joint Management and Multi-Stakeholder Processes*. Readings in Canadian Environmental Law Series.
- Nichols, S. (1983). "Tidal Boundary Delimitation." Technical Report # 103, Department of Geodesy and Geomatics Engineering, University of New Brunswick, Canada.

- Nichols, S. and D. Monahan (1999). "Fuzzy Boundaries in a Sea of Uncertainties." 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.
- 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." Prepared for the Department of Fisheries and Aquaculture. March 2001.
- 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." Prepared for Natural Resources Canada, Legal Surveys Division. September 2001, 71 pp.
- Noël, P. (2002). Personal communication, fishing boat captain, Shippagan, New Brunswick, Canada.
- Paquet, G. (1999). *Governance Through Social Learning*. University of Ottawa Press.
- Reed, M. W. (2000). *Shore and Sea Boundaries*. Volume 3, United States Department of Commerce, Washington, D.C.
- Savoie, D. J. (1993). "Globalization and Governance." Research paper No. 12, Canadian Centre for Management Development, Minister of Supply and Services Canada.
- Sohn, L., and K. Gustafson (1984). *The Law of the Sea in a Nutshell*. West Publishing Co., St. Paul, Minnesota.
- Spicer, G. (2000). "Power of community and government collaboration." Paper presented at Coastal Zone 2000 conference, Saint John, NB, September.
- Stanbury, W. T. (1993). *Business-Government Relationships in Canada: Influencing public policy*. Nelson Canada.
- Struck, K. and K. Dilks (1998). "Project planning and management." In *GIS Data Conversion: Strategies • Techniques • Management*, Hohl, P. (Ed.), Onward Press
- Sutherland M (2003). *Marine Boundary Requirements in Support of Good Ocean Governance*. Ph.D. thesis in progress, Department of Geodesy and Geomatics Engineering, University of New Brunswick, Fredericton, Canada.
- Sutherland, M., and S. Nichols (2002). "Web-GIS Technologies and their Potential as Decision Support Tools for Sustainable Development." Published in the proceedings of the FIG International Congress, Washington D. C., April 2002, CD-ROM. Also published at http://www.ddl.org/figtree/pub/fig_2002/Ts3-2/TS3_2_sutherland_nichols.pdf.
- Tims, J. (2000). "Outreach and partnership initiatives ~ gathering experience in community-based watershed management." Paper presented at Coastal Zone 2000 conference, Saint John, NB, September.
- United Nations (1997). *The Law of the Sea: United Nations Convention on the Law of the Sea*. United Nations.
- United Nations (1998). "Ocean Governance: sustainable development of the seas." United Nations, New York. <http://www.un.org/Pubs/unu/963a2.htm>, accessed January 2002.

Wildsmith, B. H. (1982). *Aquaculture: The Legal Framework*. Edmond-Montgomery Limited, Toronto.

LEGISLATION CITED

Oceans Act (1996, c. 31)
The Constitution Act (1867, 30-31, Victoria, c. 3 (UK))
Canada Lands Surveys Act (R.S. 1985, c. L-6)
Canada Lands Surveyors Act (1998, c. 14)

MEMORANDA OF UNDERSTANDING CITED

Canada-New Brunswick Memorandum of Understanding on Aquaculture Development, April 22, 1989

CASES CITED

R.v. Marshall [1999] 3 S.C.R. 0456.

BIOGRAPHICAL NOTES

Michael Sutherland obtained a Diploma in Computer Science from the University of Technology (Jamaica), and a Master of Science in Engineering (land information management) from the Department of Geodesy and Geomatics Engineering, University of New Brunswick (Canada). He is currently pursuing a Ph.D. at the University of New Brunswick where he is developing global boundary requirements models in coastal and ocean management. His work experience includes 18 years in land management with the Government of Jamaica, a number of private consulting jobs related to the development of land information management software in both Canada and Jamaica, as well as lecturing in land administration. Michael is a member of the Canadian Institute of Geomatics and Vice-Chair of FIG Commission 4 (4.3: Hydrography). Michael has a number of papers published in a variety of conference proceedings and journals including "Good Governance of Canada's Offshore and Coastal Zone: Towards and understanding of the Maritime Boundary Issues" published in *Geomatica*, Vol. 54, No. 4, pp. 415-424, co-authored with Sue Nichols and D. Monahan (2001), and "Evolving Terminology: From Managing Property Rights in Marine Space to the Marine Cadastre." Published in *Hydro International*, 2002, Volume 6, Number 9, pp. 44-47, co-authored with S. Ng'ang'a and S. Nichols (2002), among others.

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