Using Canadian MPAs to Highlight the Need for Improved Tenure Information Management

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Abstract

The administration of activities, interests and uses, is an important process in marine environmental management. In this paper, the role of marine tenure information in administering marine activities and interests will be highlighted: in the context of Canadian marine environmental management. This paper focuses on the Canadian MPA program, as an example of a marine environmental management approach, and identifies: (1) opportunities in the marine tenure information management approach; and, (2) a strategy for addressing these opportunities.

1. THE ROLE OF TENURE INFORMATION IN RESOURCE MANAGEMENT

Resource management decisions have traditionally been enhanced by information systems that highlight rights, responsibilities, and restrictions individuals/ groups have with respect to the allocation of land, its use, and enjoyment of its produce [Larsson, 1991].[8] These information systems have existed for a long time[9] and provide the information for decision makers to be able to balance resource type, location, quantity, quality and environmental factors against associated public and private property rights [see for example Oberlander [1985]; Bernstein [1985]; Dale and McLaughlin [1988]; McLaughlin and Nichols [1989]).

Property is defined as an enforceable claim to the use or benefit of some valuable thing [Macpherson, 1978, p.3]. Property information therefore describes a "thing" and the enforceable claim one might have to the "thing"[10]. Land tenure can be defined very broadly as the set of relationships that outline the acquisition, use, transfer and distribution of land [McLaughlin, 1973; Crocombe, 1974; Barnes, 1985] or more specifically as the rights, restrictions and responsibilities that people have with respect to land [McLaughlin, 1975; Nichols, 1992]. In this paper, property is viewed as a subset of land tenure.[11]

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[8] These information systems are referred to as cadastres – parcel based information systems that provide information on ownership, use, and value.

[9] The origins of what has come to be accepted as the modern cadastre concept are to be found in the development of the fiscal or land taxation cadastres of Continental Europe during the 18th and 19th centuries. One of the earliest attempts to establish a fiscal cadastre was the Milanese cadastral mapping program carried out between 1720 and 1723. This program provided a series of estate maps at a scale of 1:2000 for the Italian provinces of Milan and Mantua acquired by the Austrians [McLaughlin, 1975].

[10] Property is conceptualised as consisting of the rights, objects, and subjects. In this paper, property information describes the resource, individual/s with an enforceable claim, and type of resource use claims.

[11] Nichols [1992] suggested that property, with its emphasis on 'rights' is a subset of land tenure, which is a much broader term with emphasis on 'rights', 'restrictions' and 'responsibilities'.

On land, tenure information plays a significant role in the implementation of various land use regulatory policies [Denman, 1971[12]; McLaughlin, 1975; McLaughlin and Nichols, 1989]. This is because regardless of the scale and intent of such policies, their effect will be felt at the spatial extent exercised by individual (or group) stakeholders. Implementation of land use regulatory policies also needs to be socially and politically justified - a task made easier by highlighting the effects of the policies at the proprietary land unit (or property holding) level [McLaughlin, 1975].

Several authors (e.g., Jones [1971]; McLaughlin and Epstein [1976]; Nichols [1981]; Nichols [1983]; McLaughlin and Nichols [1989]) have historically documented the need for information systems that capture tenure/property information. This can be extended to marine space based on two observations, namely: (1) coastal zone planning depends on a decision maker accessing information on, among other things, the legal framework of ownership and control; and (2) there is a need for information systems (integrating property information) for shared and integrated decision-making in marine space.

These observations are valid in Canada today as: (1) the focus remains on collection of data on the physical marine space and the characteristics that define this space; and, (2) less emphasis is put on providing integrated information at the appropriate "rights" resolution. The first point highlights the problem of understanding the vast frontier of the Canada's coastal and marine spaces.13 The second point highlights the problem of not investigating the utility of property (and tenure) information in land management. This paper addresses this second problem.

2. THE POINT OF CONJECTURE REGARDING MARINE TENURE INFORMATION

Coastal and oceans resource management consists of policies and programs that (a) affect a specific spatial extent; (b) manage resources within that extent; and, (c) affect rights to resources enjoyed by individual (or group) property holders. As such, it is reasonable to suggest that tenure information will have an effect on policy, programs, and regulations that might be proposed. More specifically, irrespective of the land/marine physical distinction, tenure information might be useful in: (1) making land use planning decisions; and, (2) justification and implementation of coastal and marine policies, programs and regulations.

This paper suggests that this is also true in a Canadian marine space context. In order to arrive at this conclusion, it is necessary to show the hypothesis to be true for Canada's coastal and oceans management approach. Specifically, this means demonstrating that

[12] Denman suggested, " if we fail to recognise that land use is a function of property rights in land, our cognisance of the truth is deficient by a whole dimension or reality" (as cited in [McLaughlin, 1975]).

[13] In the specific case of Canada, what is known today about Canada's ocean frontier is similar to what Canadians knew of the Prairies and the Arctic in the 18th and 19th centuries [Ocean Mapping Group 1999]. Internationally, Hoogsteden and Robertson [1998] observe that the vastness of ocean space has lad to scattered explorations of marine territory have been made primarily in pursuit of narrow goals, e.g., development of identified oil and gas reserves, communication infrastructure, and coastal navigation. The vastness of ocean space leads to information systems being prioritised as monitoring and prediction systems for marine phenomena and processes [Jacob et al., 2003].

tenure information has a role in the existing policy, program, and regulatory structure described by Canada's national approach to coastal and oceans management. To demonstrate this, the next section begins by outlining the framework for Canada's coastal and oceans management approach.

2.1 Canada's Approach to Coastal and Oceans Management

Canada's *Oceans Act* [1996] represents a legislative commitment to a comprehensive approach for the protection and development of Canada's oceans and coastal waters [Canada, 2002]. To achieve this commitment, the *Act* calls for the federal Department of Fisheries and Oceans to lead and facilitate the development of plans for Integrated Management (IM).[14] The IM concept involves: (1) comprehensive planning and managing of human activities to minimize conflict among users; (2) a collaborative approach; and, (3) a flexible/transparent planning process that respects divisions of constitutional and departmental authority [Canada, 2002a]. The concept calls for an IM plan which aims to guide ocean management decisions by sharing information, consulting with stakeholders, and stakeholder advisory/management participation in the planning process [Canada, 2002a, 2002b]. Integrated Management is also a fundamental element in Canada's *Oceans Strategy* and *Oceans Action Plan*.

In the *Oceans Strategy*, a number of elements are identified as essential in Integrated Management for coastal and ocean areas [Canada, 1997b]. These elements describe a roadmap for applying the integrated management approach. A snapshot of these elements, dealing with the management of activities and interests, includes [Canada, 2002a,p.8]:

- Using existing governance structures, or establishing new ones that address multiple interest and user conflicts.[15]
- Analyzing implications of development, conflicting uses, and interrelationships between natural physical processes and human activities.[16]
- Considering cumulative effects of current and approved future human activities.
- Integrating data collection, research, synthesis, and information sharing, communication and education.[17]

The *Oceans Action Plan* asserts how this will be accomplished by targeting the development of IM plans for Large Oceans Management Areas (LOMA) and Coastal Management Areas (CMAs)[Canada, 2002a, 2002b]. The DFO *Policy and Operational Framework for Integrated Management of Estuarine, Coastal and Marine Environments in Canada*[18] indicates that the establishment of IM plans includes the development of a

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[14] A review of the *Oceans Act* [1996] indicates that there are several principles that are central to the Canadian approach to coastal and oceans management. Section 30 of Canada's *Oceans Act* [1996] provides for the *Oceans Strategy* to be based on the principles of sustainable development, integrated management of activities, and the precautionary approach [Canada, 1997b, 2002a,2002b].

[15] Includes encouraging all resource managers to consider social, cultural, economic and environmental impacts of decisions.

[16] Includes promoting linkages and harmonization among sectoral coastal and ocean activities.

[17] As part of a full range of relevant knowledge to be applied to the planning and decision-making processes.

[18] The policy and operational framework document outlines: (1) the policy concepts and principles; and, (2) an operational framework with governance, management by areas, design for management bodies, and type of planning processes involved [Canada, 2002a].

system of Marine Protected Areas (MPA) - arising from the legislative mandate outlined in section 35(2) of the *Oceans Act* [1996] [Canada, 2002a]. MPA implementation is a core tactic in Canada's *Oceans Act* [1996], *Oceans Strategy* and *Oceans Action Plan.*

2.2 An Important Opportunity in Canada's Approach

The design of the previously mentioned *Policy and Operational Framework for Integrated Management of Estuarine, Coastal and Marine Environments in Canada* involves (among other things) establishing an IM plan, and a network of MPAs within the plan. In this design, individual MPAs are considered the building blocks of this network. Although different in scale, IM and MPA management plans in Canada have several similarities. Both plans [Canada, 1998; 2002a]:

1. fall within multiple jurisdictions (i.e., provincial, territorial or community);
2. take into account specific policies, plans and legislation that apply in an area;
3. are tailored to environmental settings and existing proposed oceans uses;
4. may be presented as a series of recommended management actions directed towards specific oceans uses;
5. may be presented as a zone identifying areas of preferred oceans use; and,
6. are built through collaboration as a governance model, and adaptive management as a key philosophy.

In general, both plans suggest spatial management of resources, a focus on rights to resources, and the interaction of individual (or group) stakeholders. MPA plans are narrower in scope since they manage human activities within designated coastal and marine spaces by regulating them more stringently than elsewhere, typically to achieve certain conservation objectives (see Canada [1997a]; *Oceans Act* [1996]). IM plans are broader in scope since they focus on managing shared use of ocean spaces through governance strategies.

The effectiveness of both plans is based on the assumption that there exists: (1) a consistency and completeness in documenting interests, activities and uses involving resources; and, (2) an integrated inventory of this information across departments, agencies, governments and general stakeholders. Both assumptions are incorrect (see for example, Monahan and Nichols [1999]; Nichols et al [2001, 2002]; Ng'ang'a et al [2004]). This paper further analyses the reasons why both assumptions are incorrect in an attempt to highlight possible areas of improvement in tenure information management.

To accomplish this, this paper *clarifies, describes,* and *demonstrates* tenure information use in Canada's coastal and oceans management. Specifically, it reviews this in an MPA establishment and management context. The next section outlines the MPA program in Canada.

2.3 An Overview of Canadian MPAs

The Canadian Government has three formal protected area programs for the marine environment [Canada, 1998, 2002c]. These are administered by Canadian Heritage (Parks Canada), by Environment Canada and most recently by Department of Fisheries and Oceans (DFO). These are outlined in Table 1 below.

Table 1: Federal Marine Protected Areas Programs (after Canada [2002c])

Agency	Legislation	Protected Areas Program
DFO	Oceans Act	Marine Protected Areas
Parks Canada	National Parks Act	National Marine Conservation Areas (NMCA)
Environment Canada	Canada Wildlife Act	National Wildlife Areas and Marine Wildlife Areas
Environment Canada	Migratory Birds Convention Act	Migratory Bird Sanctuaries

As shown in Table 1, the DFO-MPA program is one of three federal marine conservation programs. It stands out for several reasons [Canada, 1997a; 1998]. First, it allows the designation of MPAs under broader guidelines than those provided by other programs (*known for dealing with specific habitats or species*). Secondly, designation of MPAs provides protection that is much greater than that afforded by other programs.[19] For these two reasons, DFO MPAs provide additional management tools that can be used to enhance stewardship of marine resources and their habitats [Canada, 1997a, 1998]. Therefore, reference to an MPA (or MPAs) in this paper is with reference to the DFO-MPA program.

2.4 The Need to Administer Activities and Interests in MPAs

MPAs are meant to address a wide range of marine resources and management dilemmas. They can be established for numerous reasons, and as a result, can take a variety of forms and *approaches*.[20] It is generally accepted that well-planned MPAs not only protect critical habitats and general ecosystem functions but also meet the needs and even enhance the opportunities of many different stakeholders living in the region [National Research Council, 2001]. MPAs attempt to highlight critical habitats/ecosystems; as well as human actions (interests, activities and uses) lying within a spatial extent;[21] in a formal attempt to control these actions. In other words, an important component of MPAs is the administration of activities and interests.

From the foregoing, this paper concludes that there are two information categories that are important in MPA establishment and management. These information categories: (1) highlight conservation values and, (2) identify human actions on the environment. The first information category depends on science information, and is used to set the parameters (goals, objectives and indicators) for conservation. The second information category depends on information on human actions (interests, activities and uses); identified in land management research as tenure information (see for example Denman [1971]; McLaughlin [1975]).[22] It is therefore reasonable to conclude that tenure information is important in managing MPAs.

[19] For example, MPA management plans can define buffer areas adjacent to the MPA boundaries whereby certain activities are restricted [Canada, 1997a].
[20] Generally, it is accepted that MPAs are established for: helping to preserve important fisheries, for protecting historical and cultural resources, for conducting scientific research, for preserving natural communities and freeing them from exploitation, and for establishing parks for diving [Canada, 1997a].
[21] MPAs are implemented within a specific spatial extent within which regulatory restrictions are imposed.
[22] As mentioned in the first section, human actions can be equated to land use.

3. WHAT ARE THE OBSTACLES IN IMPROVING MPA TENURE INFORMATION MANAGEMENT?

Generally speaking, information on the marine environment, its resources, and uses, is considered critical in identifying, evaluating, and managing MPAs [Canada, 1997a; Canada 1998]. However, several publications (e.g., Canada [1997b]; Fenton and Westhead [2000]) underscore that MPAs are to be identified, established and managed with a focus on ecological data. [23] This leads to two observations: (1) there is a focus on science as the basis for MPA establishment and management; and, (2) this focus on science results in a de-emphasis on resource use, activities and interests.

The first observation suggests that science information is the basis for MPA establishment and management (see for example Canada [1997a; 1998]). This is reinforced by the MPA program documentation, which specifically indicates that, "…ecological values may be more important than technical and socio-economic considerations [Canada, 1998, p.17]". [24] This is not surprising as MPAs are intended to protect and conserve the marine environment-and science is the best way of setting parameters for protection and conservation.

The second observation suggests that MPA activities, interests and uses are of lesser importance in planning and management than science information. This de-emphasis can be found in the grouping of tenure information with other data categories that cover several other information types. For example, umbrella terms such as "socio-economic data" or "technical data" are used to capture all other data that is not ecological. In fact, there is limited reference in MPA program documentation of property information requirements and use of this data in MPA establishment and management.

These two observations are a starting point for explaining why there is a lack of focus (and appreciation) on the importance of tenure information management in the administration of marine activities and interests. The following sections will try to highlight other possible reasons why there is the so-called de-emphasis on tenure (and other) information categories in MPA establishment and management.

3.1 Historical Bias in Marine Environmental Management Approaches

As previously mentioned, coastal and oceans management also depends on science to provide parameters for management. A framework based on goals, associated objectives, and corresponding information needs is generally used to evaluate management success.

[23] For example, when this author first got involved in MPA research in 2000, there was an increasing focus on establishing a network of MPA and the information requirements associated with this process [Canada, 1998, p.10]. As the lead agency for administering the MPA program under the *Oceans Act* [1996], DFO was initially focused on identifying the requirements and components of a "national network of MPAs", bringing together individuals that shared an interest in MPAs, and collaboratively developing the conceptual frameworks and outlining general information requirements [Fenton and Westhead, 2000, p.2].

[24] This apparently is an internationally accepted practice. For example, based on its long time MPA experience Australia proposed to Canada "…that non-ecological goals should be regarded as modifiers of the primary biodiversity or ecological goals once candidate MPAs have been identified and selected [Fenton and Westhead, 2000,p.13]". This suggests that these non-ecological goals have a negligible role in the identification and selection of MPAs.

These frameworks generally describe: (1) MPA goals and objectives; (2) indicators that measure the objectives; and, (3) data /information requirements to support the measurement of the indicators.[25]

Based on management goals and objectives, individuals or groups may exert influence on resource use from three primary perspectives: environmental, economic and institutional perspectives. The predominant view in Canadian marine management is the environmental perspective, more specifically, the primary function of conservation in marine environmental management. The term conservation consists of the management goals of protection, preservation and restoration. These management goals are value judgments that may be reflected in policy, program, or legislative objectives. As previously mentioned, marine conservation value judgments have historically been biased towards science [Agee and Johnson, 1988].

This is noted by several authors (e.g., Agee and Johnson [1988], Grumbine [1994]). Grumbine [1994] notes that responsibility for marine environmental management traditionally fell on individuals who were biologists, first, and managers, second. Therefore, it took the work of managers to ensure that planning and management "no longer discount *(ed)* the effects of humans on ecosystems." [26] In fact, the concept of ecosystem management emerged from the realisation that biologists and managers had to take into consideration the complex social context of environmental management.

3.2 Traditional Sectoral Approaches to Management

The complexity of marine space interests, activities and uses has been mentioned as a possible reason why there is a de-emphasis in tenure information management in MPAs. This has led to the impression that a comprehensive approach to managing tenure information will be difficult to implement. Some reasons why tenure information management is considered complex are outlined below.

First, there is a mix of local, provincial, and national interests in marine space, which are responsible for managing activities and uses. With regard to the nature of property in marine space, there tends to be a continuum of ownership. For example, coastal areas have a mix of public and private property and offshore areas are dominated by public property. This generalization varies across jurisdictions and cultures and is the source of great uncertainty regarding tenure-related information (see for example Cicin-Sain and Knecht [1998, p.44]).

Second, government institutions generally consist of single purpose agencies. This is because the traditional use of marine space before the 20th century was characterized by two uses: navigation and fishing [Cicin-Sain and Knecht, 1998]. Conflicts between these uses were few and as a result, separate institutions managed fishing and navigation. Thus, a

[25] Several such frameworks have been described in MPA research (see for example Fiske [1992], Kelleher et al.[1995], Kelleher and Recchia [1998],Brody [1998a,b], Hockings et al. [2000], Sutinen et al. [2000], Berkes et al. [2001], Ehler[2003], Pomeroy et al. [2004]).

[26] Although the work of Agee and Johnson [1988] and the reflections of Grumbine [1994; 1997] were in the context of (dry) land resource management, these ideas and concepts are similarly valid, and valuable, in marine space.

sectoral approach to marine management emerged. Additionally, within some fishing sectors, a single species approach was implemented based of the economic value of the species. The single species and sectoral approach to marine management produced several independent programs that were narrow in scope and vision (i.e., they did not consider the long-term, direct and indirect impacts on the social, economic and environmental dimensions [Bowen and Riley, 2003; Ehler, 2003]). This has produced a "silo" approach to tenure information management.

Third, the physical characteristics of marine space provide certain tenure administration challenges. For example, the water, living resources (e.g., fish), and non-living resources (e.g., sand and gravel) change location over time, in a vast water-filled frontier that spans much of the earth. This fluid and dynamic nature is further complicated by the intricate relationships that exist between diverse marine ecosystems and the environments that support them [Cicin-Sain and Knecht, 1998]. This provides for a complex physical environment in which marine activities and uses are managed.

3.3 Difficulty in Applying Land Administration Concepts to Marine Space

Tenure administration in marine space differs from land for several reasons. The primary reason is that marine spaces are not physically occupied, owned, or used, to the same extent as (dry) land space. This is important as it indicates that these traditional tenure concepts cannot be similarly used to uniquely identify and manage marine space. An ownership unit in marine space, similar to one found on land, might be difficult to wholly replicate (although waterlots and similar units may be the exception). Not only is this is a source of divergence between land management concepts and those for marine space; it also affects the information systems that are used to manage marine space.

To overcome this, tenure information systems may use alternative management units in marine space. Surrogates for ownership that have traditionally been used in land management include *use* and *value* (see for example Moyer and Fisher [1973]). For example, land *use* units have been used to provide information that is used in land management. *Value* units based on what constitutes an "assessable parcel of land" have also been used in land management. In marine space there are several instances of such *use* and *value* parcels and it may be more appropriate to manage marine space at these resolutions.[27] However, the lack of a standard unit for tenure information management is an obstacle for improving (and integrating) information in marine space.

3.4 Implicit Bias in the Policy and Program and Legislative Framework

Canada's *Oceans Act* [1996] provides a framework for coastal and oceans management initiatives and mandates the preparation of a national strategy. *Canada's Oceans Strategy* (COS) responds to this by providing a policy framework intended to guide the co-ordination and management of marine activities [Canada, 1997b; 2002b].

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[27] Oil and Gas lease and licence management in Canada provides an example of a hybrid *use* and *value* based management approach. Similarly, the spatial extent of fishing licences and quotas in Canada is outlined in the zones of the *Fishing Zones of Canada Orders* (C.R.C., c. 1547, 1548 and 1549).

Three policy objective (or outcomes) of COS have been identified for the advancement of coastal and oceans management activities [Canada, 2002a]: (1) understanding and protecting the marine environment; (2) supporting sustainable economic opportunities; and, (3) international leadership.

The management objectives used to accomplish the previously mentioned policy objectives are defined in Canada's Oceans Strategy (COS) as guiding principles. These three principles (or management objectives) are [Canada, 2002a; 2002b]: (1) sustainable development, (2) integrated management, and (3) the precautionary approach. These are shown in Figure 1.

The precautionary approach management objective is seen as emphasizing the environmental objective in marine management, as well as the primary goal of conservation [Canada, 2002b]. This approach is defined in the Oceans Act [1996] as "erring on the side of caution" and provides a priority to maintaining ecosystem health and integrity when managing human activities.

The important point to note is that the precautionary approach is an important principle that is always taken into consideration in coastal and oceans management decision-making. This suggests that science (used to set ecosystem health and integrity parameters) has priority in marine environmental management. And although sustainable *development* and *integrated management* objectives suggest the importance of other information types in decision-making, they are mitigated by this approach.

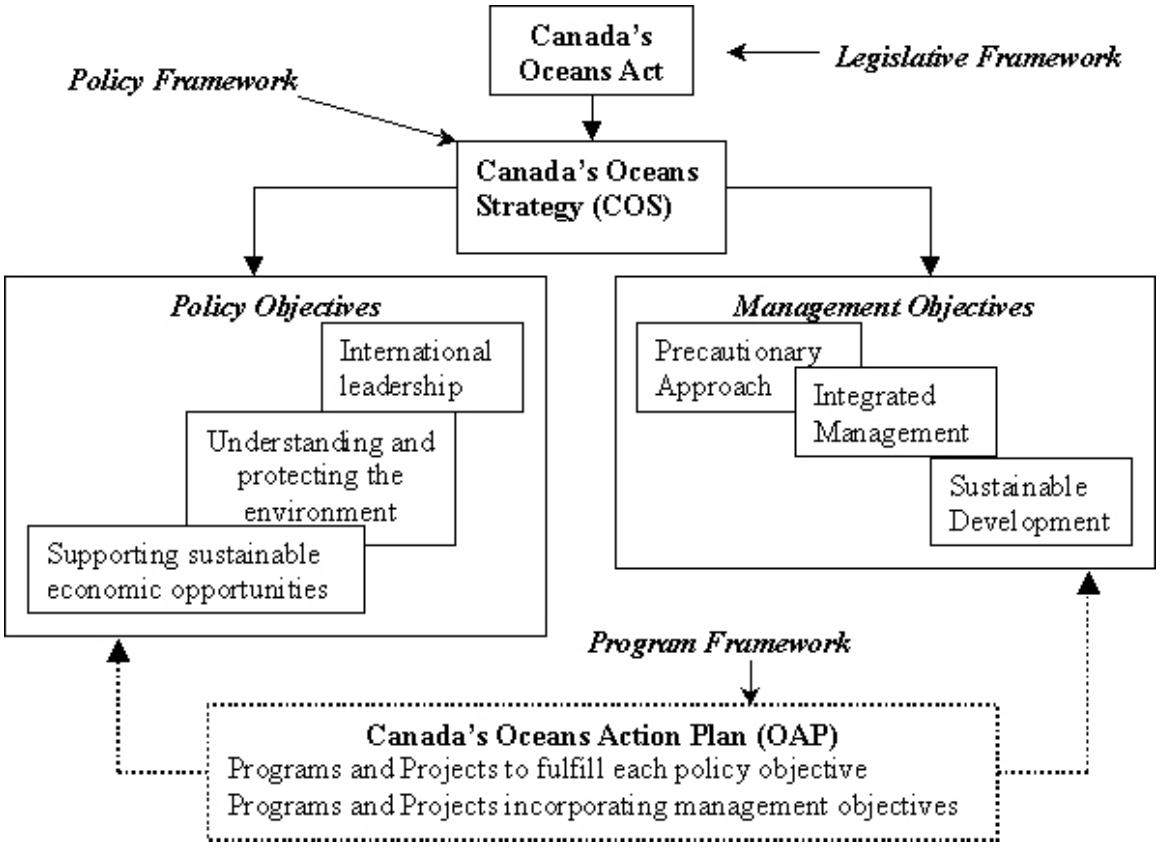

Figure 1: Canada's marine environmental management framework
(from Ng'ang'a [2006])

3.5 The Legacy of Fragmentation in Policy and Program Approaches

In Canada, federal and provincial governments departments conduct regulation of human activity in marine space. As a result, human activities face a complex, duplicative and costly array of approval processes. Policy and program based solutions are being proposed to alleviate this fragmentation.

Canada has embarked on an ambitious program called Smart Regulations, which represents a pro-active approach to improving the administration of activities. 28 This approach is meant to motivate public decision making to be inclusive and the general idea is to make the system of policy, programs and legislation less complex. It facilitates the evaluation of proposed activities using a standardized and harmonized approach across jurisdictions. Strategies for this approach are summarised in Figure 2.

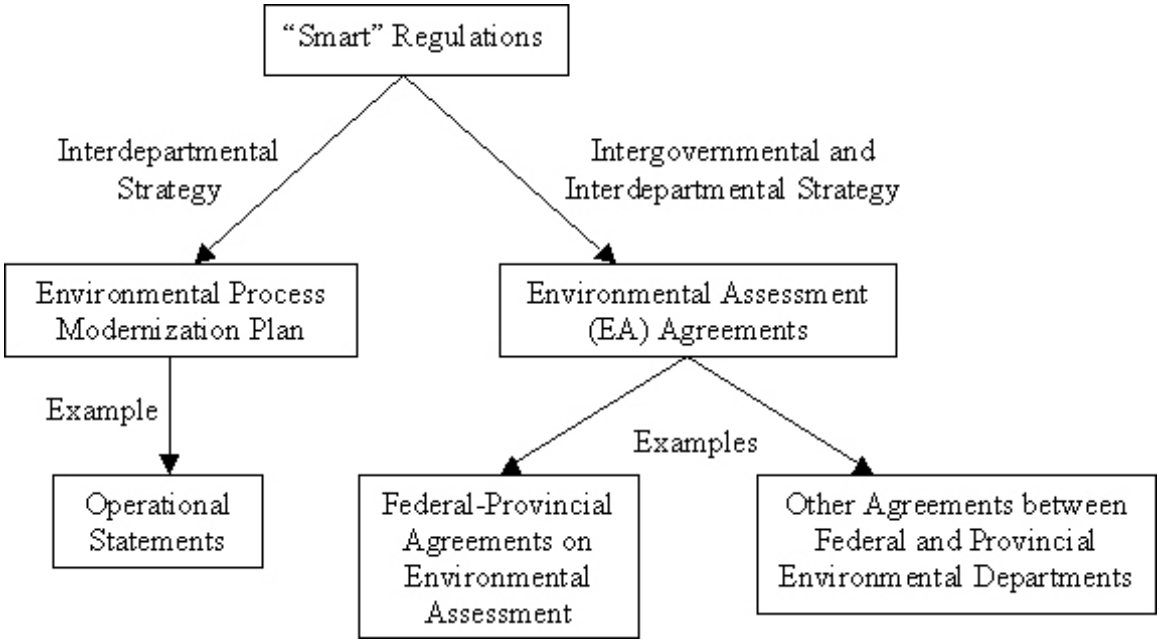

Figure 2: *Smart Regulations* activities and examples (from Ng'ang'a [2006])

[28] *Smart Regulations* is a federal government initiative whose objective is to "modernize regulation to enhance conditions for an innovative economy while finding improved ways to meet high standards of social and environmental protection"[Canada, 2005b]. See the website at http://www.pco-bcp.gc.ca/smartreg-regint/

Table 2: Tenure administration challenges not addressed by *Smart Regulations* initiative

Tenure Administration Challenges	**Description**
No emphasis on improving tenure information management	It focuses on simplifying policy, program and regulatory complexity by addressing the application process for licences and leases. There is no mention of what happens with the tenure information arising from the application process.
Does not incorporate other tenure information sources	There is an implicit assumption in this initiative that the regulatory instruments being harmonized are the primary source of tenure information. There is no acknowledgement of other tenure administration options.
Does not explicitly address tenure administration continuity	While new applicants may benefit from the regulatory harmonization, there is no mention of a standard approach to handling conflict from previously approved applications.
Does not address the sectoral management approach	Specific programs in the *Smart Regulations* initiatives do not address the sectoral management approach. This means that activities in other sectors may be overlooked especially if these sectors don't have similar programs.
Does not address vertical integration of management approaches	This initiative may address challenges across Federal/Provincial department and agencies but may not address other government institutions e.g., First Nations and Municipalities.

The *Smart Regulations* initiative can be considered a form of tenure policy, program and regulatory reform. The focus is on simultaneously trying to improve the administration of activities controlled by public authorities, and the comprehensive enforcement of public interests. This represents an important first step but does not by any means address, or even emphasise, tenure information management. Examples of marine tenure administration challenges that are not addressed by this initiative are outlined in Table 2.

3.6 Lack of (Explicit) Emphasis on Tenure Information Management

A review of *Canada's Oceans Strategy* (*COS*) and Canada's *Oceans Action Plan* (*OAP)* indicates that there is an integrated information management approach, which consists of two primary strategies. First, *COS* advocates an approach focused on inclusive information management i.e., the inclusion of local and traditional knowledge [Canada, 2002b, p.22]. Second, *OAP* adopts an approach that is primarily focused on governance reform: improving information management through [Canada, 2005a, p.8]: (a) governments working together; (b) bringing sectors and citizens together using more open and transparent management and advisory bodies; and, (c) pursuing ecosystem-based approaches.

However, both strategies only provide a starting point for improving tenure information management as part of their integrated information management approach. There are several other issues that also need to be addressed as shown in Table 3. From this, one can

suggest that the *COS* and *OAP* integrated information management strategies may be indirectly contributing to the de-emphasis of tenure information management.

Table 3: Marine tenure information management recommendations regarding *COS* and *OAP* integrated information management strategies

Integrated Information Management Strategies	Marine Tenure Information Management Recommendations
Canada's Oceans Strategy (*COS*) advocates an approach focused on inclusive information management i.e., the inclusion of local and traditional knowledge.	▪ Use of this information is contingent on it being provided in a form and format that can be reconciled with other tenure information. Therefore, a technical strategy for including local and traditional knowledge should also be included.
Canada's *Oceans Action Plan* (*OAP)* adopts an approach of improving information management through governance reform.	▪ There is an unproven assumption that governance reform will result in improved marine tenure information management ▪ The direct focus on governance suggests a lack of emphasis on the importance of information management in administering marine activities and interests.

3.7 Lack of Interest in Tenure Information Management

A review of Canadian MPA management literature (see for example articles in SAMPAA conference [Munro et al., 2003]) indicates vague descriptions regarding: marine activity and interests information sources; their use in the decision-making process; and their specific characteristics. There is little knowledge whether coastal zone information systems being assembled are adequate for establishing or managing MPAs. Additionally, little is known about how organizations and groups will be able to share their information within these systems; or the appropriate form, format, and content of their information.

The collaborative and co-management approaches (in the MPA IM approach) suggest that stakeholder groups may have certain types of information that may impact on decisions. However, there is little guidance as to the types of information these agencies and groups may have in their possession. There are also no examples of how it is to be used and whether any information sharing protocols and standards are established. In summary, the issue of tenure information management is still flying under the coastal and oceans management radar.

3.8 Bias in Tenure Information Systems Development

In Canada, there has been a legacy of information systems dealing with specific programs, uses, and activities [Hildebrand, 1989; McLean and McLaughlin, 1989]. A review of Canadian authors works on information systems gives the impression that tenure information management is considered in the very narrow context of managing a specific resource or species e.g. fishing, petroleum drilling, mining, construction of public utilities, aquaculture etc [Butler et al., 1986; McLean and McLaughlin, 1990; Coffen-Smout and

Herbert, 2000]. This narrow focus of tenure information (in the context of managing specific resources) has affected the development of inclusive and complete tenure information systems.

This "single" resource-based focus on tenure information management is a legacy of traditional information systems development (see Butler [1986]). It is further fragmented by jurisdictional and administrative responsibility, and complicated by data custody issues (arising from "silos" of information in the custody of various agencies, departments and institutions [Nichols et al., 2001; 2002]).

This paper suggests that there are three categories of tenure information systems that need to be integrated as a starting point for an inventory of tenure information in marine space. These are: (1) near shore examples of tenure information systems that extend "dry" land registration concepts to the intertidal zone e.g. registration of water lots and aquaculture leases [Nichols, 1983; Nichols et al., 1997];(2) information systems that focus on the spatial extent of tenure in environmental areas e.g. marine parks, marine protected areas, heritage areas, bird sanctuaries etc [Nicholls, 1998; Jamieson and Levings, 2001;Ardron et al., 2002]; (3) information systems focusing on tenure instruments needed for economic activities of particular resources e.g. petroleum leases. All three categories need to be further investigated.

4. CONCLUDING REMARKS - REITERATING THE NEED TO IMPROVE TENURE INFORMATION MANAGEMENT IN MPAS

The previous sections have noted the obstacles in improving tenure information management by analysing the MPA establishment and management framework in Canada. From this review, the importance of improved and integrated tenure information management has been inferred. However, there is a need to reiterate the need for improved tenure information management in the administration of human activities, uses, and interests.

There is no doubt that there should be greater focus on tenure administration and improving tenure information management. After all, MPA establishment and management involve engaging a diverse range of parties with a decision-making role, interest, or specific knowledge of the area. This collaborative management approach depends on a shared understanding so that "dialogue can occur on the issues, objectives and options" [Canada, 2002a, p.26].

This might include being able to visualize how existing and proposed regulations will affect rights of individuals, community, and other stakeholders (see for example, LSLK [2002]). Additionally, it might be necessary to not only implement but also justify land use regulatory policies associated with the MPA. This depends on tenure information identification and management. Therefore, an investigation into tenure information requirements, and the role of tenure information in MPA establishment and management, is essential.

MPAs are created to protect a specified location from certain human impacts. This implies that marine activities and interests are important. Therefore, the information systems used

to establish marine activities and interests are as important as the ones used to determine the state of the marine environment in which activities take place.

This paper concludes with the following observation : protecting marine ecosystems involves more than a cursory inspection of other information types. This also applies for information on marine activities and interests. As observed by some researchers, "…science by itself cannot answer all the (*planning and management*) questions…[LSLK, 2002, p.10]". The conference on "Making the Linkages work in Canada's MPAs" provided direction on the need to improve tenure information management by recommending that,

> *"MPAs are about managing peoples activities and therefore their success depends on how well cultural, economic and social values are integrated. Issues like land-use, property rights, distribution of income, community decisions cannot be considered separately from ecological objectives. If certain values are considered separately or ignored, then the overall effectiveness of an MPA as a management tool is diminished [LSLK, 2002,p.32]".*

REFERENCES

Agee, J.K., and D.R. Johnson (1988). *Ecosystem Management for Parks and Wilderness*. University of Washington Press, Seattle, Washington.

Ardron, J.A., J. Lash, and D. Haggarty (2002). *Modelling a Network of Marine Protected Areas for the Central Coast of British Columbia*. Version 3.1. Living Oceans Society, Sointula, B.C., Canada.

Barnes, G. (1985). "Land Tenure Issues in the Third World". In *The Canadian Surveyor*, Volume 39, Issue 4, pp.436-440.

Barnes, G. (1988). *A Comparative Framework for Cadastre-Based Land Information Systems (CLIS) in Developing Countries*. Ph.D. Dissertation in Civil and Environmental Engineering, Madison: University of Wisconsin, USA.

Berkes, F., R. Mahon, P. McConey, R. Pollnac and R. Pomeroy (2001). *Managing Small Scale Fisheries: Alternative directions and methods*. International Development Research Centre, Ottawa, Canada. [Available online at http://www. idrc.ca]

Bernstein, J. (1985). "The Costs of Land Information Systems". Paper presented at the First World Bank Conference on Land Information Systems, St. Michaels, MD.

Bowen, R.E., and C. Riley (2003). "Socio-economic Indicators and Integrated Coastal Management". *Oceans and Coastal Management* , Vol. 46, pp.299-312.

Brody, S.D. (1998a). "Evaluating the Role of Site Selection Criteria for Marine Protected Areas in the Gulf of Maine." Gulf of Maine Council on the Marine Environment, Report No. 2, July.

Brody, S.D. (1998b). "An Evaluation of the Establishment Processes for Marine Protected Areas in the Gulf of Maine: Understanding the Role of Community Involvement and Public Participation." Gulf of Maine Council on the Marine Environment, Report No. 3, July.

Butler, M.J., D.J. Scarratt, and L. Macleod (1986). “Whither Coastal Mapping and Marine Resource Mapping?” In *Cartographica*, Vol. 23,No.1&2, pp. 34-35.

Canada (1997a). *An Approach to the Establishment and Management of Marine Protected Areas under the Oceans Act- A Discussion Thesis.* Public Works and Government Services, Communications Directorate, Ottawa, Ontario, January.

Canada (1997b). *Towards Canada’s Oceans Strategy – Discussion paper*. Public Works and Government Services, Communications Directorate, Ottawa, Ontario. [Also available online] http://www.cos-soc.gc.ca/

Canada (1998). *Marine Protected Areas Program*. Public Works and Government Services, Communications Directorate, Ottawa, Ontario.

Canada (2002a). *Policy and Operational Framework for Integrated Management of Estuarine, Coastal and Marine Environments in Canada*. Fisheries and Oceans Canada, Oceans Directorate, Ottawa, Ontario.

Canada (2002b). *Canada’s Oceans Strategy*. Fisheries and Oceans Canada, Oceans Directorate, Ottawa.

Canada (2002c). *Working Together for Marine Protected Areas - A National Approach*. Fisheries and Oceans, Oceans Directorate, Ottawa. [Also available online] 7 January 2006 http://www.dfo-mpo.gc.ca/canwaters-eauxcan/infocentre/publications/ brochures/ wtogeth_e.asp#coordinated

Canada (2005a). *Canada’s Oceans Action Plan: For Present and Future Generations.* Fisheries and Oceans, Communications Branch, Ottawa, Ontario. [Also available online] http://www.dfo-mpo.gc.ca/canwaters-eauxcan/oap-pao/index_e.asp

Canada (2005b). *External Advisory Committee on Smart Regulation (EACSR).* [Online] 6 January 2005 http://www.pco-bcp.gc.ca/smartreg-regint/

Cicin-Sain, B., and R.W. Knecht(1998). *Integrated Coastal and Ocean Management: Concepts and Practices*. Island Press, Washington D.C., 543pp.

Coffen-Smout, S. and G.J. Herbert, (2000). **“**Submarine Cables: A Challenge for Ocean Management”. In *Marine Policy*, Issue 24, p. 441-448.

Cohen, J.E., Small, C., Mellinger, A., Gallup, J. and Sachs, J. (1997). “Estimates of Coastal Populations”. In *Journal of Science*, 278, p.1211-1212.

Crickard, F. (1995). “Canada’s Ocean and Maritime Security”. In *Marine Policy Journal*, Vol. 19, No. 4, pp.335-342.

Crocombe, R. (ed.) (1971). “The Pattern of Change in Pacific Land Tenures”. In *Land Tenure in the Pacific*, Melbourne, London, Wellington and New York, Oxford University Press, pp. 1-24.

Crocombe, R. (1974). “An Approach to the Analysis of Land Tenure Systems”. In *Land Tenure in the Oceania*, H.P Lundsgaarde (ed), Honolulu, University Press of Hawaii, pp. 1-17.

Dale, P., and J.D. McLaughlin (1988). *Land Information Management*. Clarendon Press, Oxford.

Dale, P.F, and J.D. McLaughlin (1999). *Land Administration*. Oxford University Press, Oxford.

Denman, D.R. (1971). *Proprietary Patterns and Land Use. New Techniques and Possibilities for Land Use and Related Surveys.* The World Land Use Survey Occasional Papers, No. 9.

Ehler C.N. (2003). "Indicators to Measure Governance Performance in Integrated Coastal Management". *Ocean & Coastal Management*, Vol. 46, p.335-345.

Fenton, D.G., and M.C. Westhead (2000). "Report from the Roundtable on Marine Protected Area System Planning." *Canadian Manuscript Report of Fisheries and Aquatic Sciences 2515*, Dartmouth, Canada.

Fiske, S.J. (1992). "Sociocultural Aspects of Establishing Marine Protected Areas". *Oceans and Coastal Management*, Vol. 18, pp. 25-46.

Grumbine, R.E. (1994). "What is Ecosystem Management?" *Conservation Biology*, Issue. No. 8, pp. 27-38.

Grumbine, R.E. (1997). "Reflections on 'What is ecosystem management?'" *Conservation Biology*, Issue No.11, pp. 41-47.

Hildebrand, L.P. (1989) *Canada's Experience with Coastal Zone Management*. Oceans Institute of Canada, Halifax, Nova Scotia, 118p.

Hockings, M., S. Stolton and N. Dudley (2000). "Evaluating Effectiveness: A Framework for Assessing the Management of Protected Areas." IUCN, WCPA Best Practice Protected Area Guidelines Series #6.

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

Jacob, A., T. Hamre, G. Evensen, and K.A. Mughal (2003). "Developing a Marine Information System by Integrating Existing Ocean Models Using Object-Oriented Technology". In *Marine Geodesy*, Vol. 26, p. 87–106.

Jamieson, G.S. and C.O. Levings (2001). "Marine Protected Areas in Canada: Implications for both Conservation and Fisheries Management". *Journal of Fisheries and Aquatic Science*, 58, pp.138-156.

Kelleher, G. and C. Recchia (1998). "Lessons from Marine Protected Areas around the World". *Parks Journal*, Vol. 8, no. 2, pp.1-4.

Kelleher, G., C. Bleakley and S. Wells (1995). "A Global Representative System of Marine Protected Areas, Volume I-IV." The Great Barrier Reef Authority, The World Bank and The World Conservation Union.

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

Linking Science and Local Knowledge Node (LSLK) (2002). "Science and Local Knowledge: Making the Linkages Work." *Proceedings of the Science and Local Knowledge Workshop*, Moncton, New Brunswick, October.

Macpherson, C.B. (ed.)(1978). *Property: Mainstream and Critical Positions*. Toronto: University of Toronto Press.

McLaughlin, J. (1973). *An Introduction to Cadastral Surveying*. Lecture Notes No. 31.Department of Surveying Engineering, University of New Brunswick, Fredericton, Canada.

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

McLaughlin, J. and E. Epstein (1976). Coastal Zone Management and the Multipurpose Cadastre Concept. Proceedings of the American Congress on Surveying and Mapping, Seattle, WA, September 1976, pp. 429-441.

McLaughlin, J. and S. Nichols (1989). "Resource Management: The Land Administration and Cadastral Systems Component". *Surveying and Mapping* 49(2), pp. 77-85.

McLean, A., and J. McLaughlin (1990). *Ocean Information System Study*. Report for the Marine, Urban and Rail Directorate Industry, Science and Technology Canada, Ottawa.

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

Monahan, D. and S. Nichols (1999). "Fuzzy Boundaries in a Sea of Uncertainty: Canada's Offshore Boundaries". *Proceedings of the New Zealand Institute of Surveyors and FIG Commission 7 Conference,* Bay of Islands, NZ, Oct 9-15, pp. 33-43.

Munro, N.W.P., P. Dearden, T.B. Herman, K. Beazley, and S. Bondrop-Nielson (eds) (2003). "Making Ecosystem Based Management Work. Connecting Managers and Researchers" *Proceedings of the Fifth International Conference on Science and Management of Protected Areas (SAMPAA),* 11-16 May, Victoria, British Columbia, Canada, unpaginated-CD ROM.

National Research Council (2001). *Marine Protected Areas: Tools for Sustaining Ocean Ecosystems.* Committee on the Evaluation, Design, and Monitoring of Marine Reserves and Protected Areas in the United States, Ocean Studies Board. National Academy Press. Available online at http://www.nap.edu/books/0309072867/html/

Ng'ang'a, S.M., 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 *Computer, Environment and Urban Systems Journal*, Issue 28, pp. 443-470.

Ng'ang'a, S.M. (2006). "Extending Land Management Approaches to Coastal and Oceans Management: A Framework for Evaluating the Role of Tenure Information in Canadian Marine Protected Areas". PhD Dissertation, Department of Geodesy and Geomatics Engineering, University of New Brunswick, Fredericton, NB.

Nicholls, H.B.(1998). "Canadian East Coast MPAs: A Review"**.** In *Oceans and Coastal Management Journal*, Issue 39, pp. 87-96.

Nichols, S (1981). "Coastal Zone Management: An Assessment of Information Requirements". Technical Paper from the Department of Surveying Engineering, University of New Brunswick.

Nichols, S. (1983). “Tidal Boundary Delimitation”. Technical Report 103, Department of Geodesy and Geomatics Engineering, University of New Brunswick, Fredericton, NB, 202pp.

Nichols, S. (1992). “Land Registration in an Information Management Environment”. PhD Dissertation, Department of Surveying Engineering, University of New Brunswick, Fredericton, NB, 340pp.

Nichols, S. (1993). “Land Registration: Managing Land Tenure Information for Land Administration”. Technical Report No. 168, Department of Geodesy and Geomatics Engineering, University of New Brunswick, Fredericton, Canada.

Nichols, S., I. Edwards, J. Dobbin, K. Komjathy, and S. Hanham (1997). *Real Property Issues in the Marine Aquaculture Industry in New Brunswick***.** Report for the New Brunswick Department of Fisheries and Aquaculture, Fredericton, NB, 77 pp.

Nichols, S. and D. Monahan (1999). “Fuzzy Boundaries in a Sea of Uncertainty”. *Proceedings of the NZ Institute of Surveyors and F.I.G. Commission VII Conference*, Paihia, New Zealand, Oct 9-15, pp 33-44.

Nichols, S. E., M. Sutherland, S.M. Ng’ang’a and D. Monahan (2001). *Report on the ACLS Offshore Issues Consultation Workshop***.** Report for Legal Surveys Division, Natural Resources Canada, May, 57 pp.

Nichols, S., M. Sutherland, S. Ng’ang’a, and D. Monahan (2002). *Roles and Responsibilities for Surveying in Offshore Canada Lands.* Report for the Legal Surveys Division, Natural Resources Canada, September, 71 pp.

Oberlander, H.P. (1985). “Land: The Central Human Settlement Issue”. Human Settlement Issues, No. 7. University of British Columbia Press, Vancouver.

Ocean Mapping Group (OMG) (1999). “Challenges and Opportunities for Ocean Mapping in Canada.” Report for the Oceans Policy Secretariat, Department of Fisheries and Oceans, Ottawa, Ontario, March, 33 pp.

Pomeroy R.S., J.E. Parks and L.M. Watson (eds) (2004). *How is Your MPA Doing? A Guidebook of Natural and Social Indicators for Evaluating MPA Management Effectiveness.* International Union for the Conservation of Nature (IUCN), Gland, Switzerland and Cambridge, UK, 216pp.

Sutinen, J.G. (ed.) (2000). “A Framework for Monitoring and Assessing Socioeconomic and Governance of Large Marine Ecosystems.” NOAA Technical Memorandum NMFS-NE-158 [Available Online] http://www.nefsc.noaa.gov/nefsc/publications/tm/tm158/tm158.pdf

Legislation Cited

Canada Wildlife Act, R.S.C (1985), c. W-9

Migratory Birds Conservation Act, R.S.C (1994) c. 22 .

National Parks Act, R.S.C (2000), c. 32.

Oceans Act, R.S.C. (1996), c.31.