FROM MANAGING PROPERTY RIGHTS IN MARINE SPACE TO THE MARINE CADASTRE

Evolving Terminology

With extended national jurisdiction offshore brought about by the coming into force of the United Nations Convention on Law of the Sea (UNCLOS), new territories have emerged that need to be explored, exploited, protected and shared. The oceans are being subdivided into Territorial Seas, Exclusive Economic Zones and Continental Shelves, each with attendant rights and responsibilities. Effective marine resource management in these vast coastal regions will hopefully be based on a better understanding of the interrelationships between human activities and marine ecosystems than we have had even in the recent past.

UNCLOS has provided a legal mechanism whereby a nation can extend its claims as far seaward as the limits of the continental shelf. As it explicitly deals with the rights, restrictions and responsibilities to the physical offshore, UNCLOS has created a complex multidimensional mosaic of potential private and public interests. When coastal zone management programmes, and internal jurisdiction and administration issues are added on, a clear understanding of the nature and extent of offshore interests is crucial for decision-making purposes.

The Nature of Information Collected
In most countries of the world, plans are designed, decisions are made, and activities take place in the bordering ocean spaces without too much regard to the impact on any existing property rights. Information collected in marine space tends to have a strong scientific flavour focusing on living and non-living resources, bathymetry, shoreline changes, marine contaminants, seabed characteristics, water quality, and almost as an afterthought property rights. Property rights are particularly important because for the management of marine spaces to be truly effective, we need to know who has rights of use, ownership, and stewardship in coastal areas; that is, who has the right to make and enforce decisions offshore. This kind of information can be found in the form of boundaries (or limits) of rights and interests. The spatial extent of such rights and interests might be described by:

- Limits of private and public ownership on upland property (e.g., ordinary high water mark)
- Limits of private rights below high water (e.g., water lots, aquaculture site leases, oil and gas licenses and leases, fishing licenses)
- Municipal, county, provincial, and territorial limits of jurisdiction and administration
- Other national boundaries (e.g., Territorial Sea, Contiguous zone, Exclusive Economic Zone) and international boundaries, including national coastal baselines
- Government departmental limits
- Environmental protection areas (e.g., wetlands, marine protected areas, coastal zone management)
- Military limits (e.g., disposal and weapons firing ranges)
- Pipeline and cable rights-of-way

One might assume that the collection, overlay and integration of boundary and scientific information would result in the provision of information that would subsequently be used in a decision-making environment. While this might be true in some cases, there are certain issues regarding the information that is collected and its fitness for use which need to be considered.

Issues Surrounding the Information Collected
In various jurisdictions, boundary information collected in marine space adheres to various standards. Depending on the agency in charge of data collection, boundary information is collected in various formats, scales, currency, accuracy and precision. For example, military boundaries, indicating disposal and weapons firing ranges, might be available at high precision. On the other hand, an environmental protection area, such as a marine protected area, might have its boundary described by an isobath. Clearly, the standards to which the boundary information was collected vary dramatically, and overlaying the information in order to make any decision should only be done after properly assessing the â€˜fitness for useâ€™ of the combined information in decision-making.
But the differences in boundary information collection standards are especially noticeable when using technology to overcome the challenges in viewing property rights in marine space. Technology has advanced to a level where one can easily integrate the different boundary information and provide a multidimensional view of property rights (in relation to other features) in marine space. Any errors arising from not evaluating the â€˜fitness for useâ€™ of individual boundary information (before integration) will propagate to the multidimensional decision making environment. To illustrate this, take the case of mineral exploitation in marine space. This right to explore for minerals may have an impact on the physical layers of the seabed and subsurface, but it will also affect a three (or four)-dimensional cross-section above and below these physical layers. Policy and decision-makers would no doubt benefit from an understanding of the upper and lower bounds of the exploration rights, and how these may affect the environment or other property entitlements within the same spatial extent.
Other issues are legal in nature, such as the jurisdictional confusion that exists when countries such as Canada have a multi-tier

governance system that deals with federal and provincial governments. For example, the Canadian federal government considers the waters (and bed) from low water seaward to be under national jurisdiction. Not all of the provincial counterparts agree with this interpretation e.g. the Atlantic Provinces in Canada claim a customary three nautical mile Territorial Sea before the creation of Canada in 1867. At
the same time, the provinces have long acknowledged interprovincial boundaries between them, e.g. in the Northumberland Strait and in the Bay of Fundy. In addition, in the British North American Act of 1867, all matters to deal with â€˜landâ€™, including mines and minerals, belong in provincial jurisdiction. These three issues combined (together with others not highlighted here) already indicate the complexity of jurisdictional boundary issues in marine space.
The complexity of boundary issues also involves international jurisdictions. Take the case of boundary delineation of the international boundaries between the USA and Canada. One of the technical considerations in defining the various offshore limits under the UNCLOS is the fact that zones such as the Territorial Sea (12 nautical miles) and Exclusive Economic Zone (200 nautical miles) are measured from national baselines. The United States uses normal baselines (low water line on a navigational chart), while Canada has enclosed its coasts with straight baselines under Article 7 of the UN Treaty. At the same time, Canada and the US use different chart datums for defining the baseline points (Lower Low Water for Canada, Lowest Astronomic Tide for the US). The perception (and understanding) of boundaries of interests in Canada and US (e.g., limits of private rights, such as water lots) in coastal and marine areas, is therefore different. Clearly, there is a need for harmony in approaches regarding boundary delineation especially with regard to the resolution of boundary disputes across international borders.
Aside from technical considerations regarding boundary delineation, there are other precedents being set concerning boundary description in marine space. For example, UNCLOS has â€˜muddied the watersâ€™ by proposing that scientific information can also be used as evidence of a boundary. Several authors [e.g. Monahan and Mayer, 1999; van de Poll et al., 1999] indicate that the scientific and technical guidelines of the Commission on the Limits of the Continental Shelf (CLCS) provide specific guidelines on the types of data that can be used to prepare a claim under UNCLOS. The interpretation of this guidelines leads to the general agreement that navigation data, raw water depth (bathymetric data), field values of magnetic fields, calculated water depths, free-air gravity and magnetic anomaly, should make up the data content of such a claim. This represents a new approach in boundary delimitation as scientific information is actually being used to provide evidence of a juridical boundary. Clearly, such a boundary would be incorporated in a property rights information system as it represents the spatial extent of a Nationsâ€™ rights and interests.

The Management of Property Rights Information
On land, information relative to a jurisdiction, regarding the effects of its private and public laws on the environment (e.g. spatial extents and their associated rights, responsibilities, and restrictions etc.) has traditionally been stored in a cadastre. McLaughlin [1975] defines a cadastre as â€˜a parcel-based record of interests in land encompassing both the nature and extent of these interestsâ€™. Other relevant information regarding the physical and biological natures of the environment (among other things) has usually been additionally stored in order to give the cadastre a multipurpose function. The multipurpose cadastre concept has been traditionally designed on a three-dimensional spatial unit (parcel) representing unique, homogeneous, contiguous interests [see McLaughlin, 1975; NRC, 1980; Moyer and Fisher, 1978]. Sometimes we even think of the cadastre as also representing a fourth time dimension i.e., time-shared interests.
Parallels can be drawn between the cadastre approach to land information management and the governance of our marine spaces. After all, the definition of the land parcel is broad enough as to also include water that lies above or below the physical entity that we commonly perceive to be land, i.e. that which is the product of â€˜geological and geomorphological processes of the earthâ€™. And although there may be arguments advanced about the need to differentiate between approaches regarding the governance of our land and marine spaces, there is clearly a pressing need for harmony when proposing governance structures, as one moves from onshore to offshore spaces.

The Marine Cadastre Approach
We view a marine cadastre as an important part of any nationâ€™s geospatial data infrastructure. No nation can claim to have complete, seamless, and comprehensive information on marine rights (public and private; formal and traditional) and marine jurisdictional limits in addition to the vast catalogue of most nationsâ€™ scientific information. But most nations have the bits and pieces in place, albeit in various geographical locations; in different formats, scales, accuracies and precision; and in the custody of various agencies.
It is impossible to talk of a cadastre without defining the spatial dimensions and type of interests that are represented in a parcel. And therein lies our problem (as shown in Figure 1) for in the oceans where resources and activities - and therefore rights and restrictions - can co-exist in time and space and can move over time and space, the definition of a parcel is even more complex. Furthermore, it may not be the best unit of representation for all interests. We maintain that although there might be other approaches that exist, until another framework is proven more useful, the cadastral concept may help the initial exploration of ideas. However, it may be more useful in the long term to look at broader contexts such as property rights infrastructure, MGDI, and environmental or ecological units in order to ensure that we are not asking the resources and their management to follow our sometimes arbitrarily straight surveyed lines in space.

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