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Estimating the Economic Value of Canada's Coasts and Oceans: Theoretical and Methodological Issues

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Table of Contents

Introduction: Why Measure the Economic Value of the Oceans and Coasts?

Efforts to measure the economic value of ocean resources have been underway in fits and starts in the United States and Canada for more than thirty years. The first American study was prepared by the Bureau of Economic Analysis in 1974. There are studies too numerous to mention of the individual sectors of the ocean economy, from fisheries to energy and studies of the marine economies of provinces such as New Brunswick and Nova Scotia have been undertaken. The results have been useful, but highly fragmented snapshots of the economic value of the ocean.

This paper examines the issues that surround attempts to create more systematic measurements of ocean economic values. It builds on recent experience in the United States and explores the choices that Canada confronts should Canadians choose to undertake a similar effort.

At the outset, the need for such measurements should be clear. There are three major reasons why a more systematic and sustained approach to measuring ocean economic values is desirable:

1. Understanding the economic value of the ocean is essential to understanding the role of the ocean in comparison with other economic activities (many of which, such as agriculture, are much more thoroughly measured), and, most important, to understand the changing nature of the economic values associated with ocean use as a guide to sound policy and investment decisions in both the public and private sectors.

2. The measurement of change in economic values van be linked to changes in ecological and resource conditions. The links run both ways. Changes in ecological conditions affect the magnitude and nature of economic values, while changing economic uses of the oceans alter human impacts on ecological values. Systematic measurement of economic values is essential to developing both informal and formal models that explore, explain, and predict the interactions between economic and ecological values. Informal models include the increasing use of "indicators" of change as guides to policy. Formal models are fully specified mathematically and empirically verified and require substantial data..

3. To be useful, measurement must be consistent across time and space. Measurements should be consistent with underlying theory and permit comparisons of values across different types of economic activities, whether a day at Cavendish Beach or a barrel of oil from Hibernia. Current piecemeal approaches make meeting these conditions difficult and limit the possibilities for formal modeling of economic-ecological interactions.

What is meant by "economic value"?

There is no single "economic value". Rather there are multiple ways in which economic value is created and measured. A full exploration of the theoretical underpinnings of economic value is beyond the scope of this paper, but there are several basic ideas which provide the framework for choosing approaches to measuring ocean values:

Market values When goods and services are bought and sold, the value of the good and service is determined as the price paid. The total value is equal to the price paid per unit multiplied by the number of units sold. This is the standard measure of value of the size of economic activity, such as the gross domestic product. Other common measures of economic activity based on market values include employment and wages. These are often of interest to policy makers and are estimated with GDP.

Non-market values Value ultimately reflects how people view the usefulness of a good or service, and it is possible that people may view values as more than what the cost of a good or service is in the market. These non market values derive both from people's direct experience (called use values) and from their awareness of potential values even if they do not directly use the good or service (non use values). Common examples in the ocean context might include the scenic values of a coastline such as Cape Breton's Cabot Trail, or the value that people place on whales even if they have never seen one personally.

Flows of value When transactions in the market place take place, or people provide the value they place on a day at the beach, the values are part of a flow of values. In the case of market values, these flows are measured at intervals (usually monthly, quarterly, or annually) and changes in the levels of values at each interval are considered to be measures of the flows of value created in the measured time period. The GDP (the total output of goods and services in an economy) is perhaps the best known flow measure.

Stocks An alternative measure of values is the value of a stock, which is equal to the present value of future flows. The value of real estate is a common example. In economic theory, the price of real estate is the discounted present (adjusted for time) value of future goods and services that could be produced from the land. Ocean resources are not commonly sold on the same basis as land-based real estate, but the same principle applies. For example, the value to the lessor of an aquaculture site should be equal to the value of the cultured fish that could be produced on that site (net of all other costs) over the life of the lease.

These concepts produce four basic alternatives for measuring value:

	Market Values	**Non-Market Values**
Flows		
Stocks		

The first row of cells in the table measure flows of market or non market values at different time intervals, which is the periodic level of economic activity associated with the ocean. The second row shows measures of the stocks of value- what is a resource worth at any given point in time based on expectations of the future flows of value.

To illustrate, take a scenic area such as the Cabot Trail. The annual flows of market values would be the output, employment and wages of firms in Cape Breton who sold goods and services to visitors to Cape Breton National Park, plus the services provided by Parks Canada. The non-market flows would be the values placed on the scenic and recreational experience in excess of what was actually paid to travel to the park. The stock of market flows would be reflected in the value of the lands surrounding the park used to serve visitors, while the stock of non-market value would be the time-adjusted value of all the flows of value of future visitors.

The existence of multiple values as discussed above has led to concerns that the adequacy of the most common measures of economic activity- the gross domestic product- is inadequately representing the true measure of economic wealth in a nation. This is particularly the case with respect to the value of natural resources (natural capital) both as a source of value and, because of pollution and over use, a potential loss of current and future values. The National Roundtable has been a leader in bringing this concern to Canada.

The challenge in creating the measures of the ocean economy that can satisfy the needs identified in the first section, therefore, may be summarized as finding the appropriate strategies to create measures appropriate to each of the cells in the table. This would be necessary to provide a complete picture of ocean values. However, there a number of practical issues that must be confronted in developing a strategy for measuring ocean economic values. These include:

- Limitations in existing data series for even the most basic market measures
- Theoretical and methodological complexities in measuring non market measures
- The difficulty in understanding the changes over time needed to accurately measure stock values (whether market or non market)

In our work in the United States, we have chosen to tackle the first two issues as the initial approach to measuring ocean economic values. This is partly because the data issues are more manageable for the resources available and partly because resolution of these issues is the essential first step before the third issue can be addressed. To illustrate both the issues and their implications for ocean economic value measurement, the following section describes the work of the U.S. National Ocean Economics Project. The succeeding section examines the implications for the U.S. work for Canada, followed by a discussion of issues in measuring stocks of values.

What work is being done in the U.S. to improve understanding of the ocean economy?

The National Ocean Economics Project is a partnership between the National Oceanic and Atmospheric Administration (NOAA) and a team of researchers based at universities in California and Maine. (For more information, see the Project website at www.oceaneconomics.org.) The goals of the project are to significantly expand the economic data and information available about ocean and coastal resources in the United

States. The Project's current focus is on developing data series to measure output, employment and income from ocean related economic activity at the national, state, and county levels; to compile a master database of ocean-related economic statistics; and to develop improved means to use non market value estimates of ocean and coastal resources. Substantial progress has been made on the first of these tasks, and work is beginning on the second two.

The measurement of the U.S. ocean economy from a market perspective rests on three key ideas. The first is the distinction between the ocean economy and the coastal economy. The ocean economy consists of all economic activity which directly or indirectly uses the ocean as an input. The coastal economy is all economic activity that is located in or affects the coastal zone. The distinction is necessary in order to separate economic activity directly related to the ocean from surrounding changes in the economy that may indirectly affect (or be affected by) ocean resources.

The second key idea is the identification of industries associated with the ocean economy. Seven sectors have been identified:

Living resources (fisheries and aquaculture)
Minerals (Oil and gas, sand and gravel)
Transportation (Ocean born transportation of goods)
Ship & boat building
Tourism & recreation
Marine Construction
Scientific research
Government

The specific industries comprising these sectors are identified using standard industrial classification (SIC) or North American industrial classification (NAICS) codes.

The third key idea is identifying activity by geographic location. This is necessary in measuring both the coastal economy and the ocean economy. Three tiers of coastal regions are identified: the near shore region, the coastal zone, and coastal watersheds. This permits analysis of economic activity in close proximity to the shore and ocean as well as upland areas where the effects of economic activity may be carried to the sea via riverine systems. For the ocean economy, certain industries, such as those in tourism and recreation, are defined as connected to the ocean only by their location near the shore.

The primary data set used to measure the ocean and coastal economies is the Quarterly Census of Employment and Wages (QCEW), a cooperative program of the states and the Bureau of Labor Statistics. This is data on employment and wages collected at the establishment (place of employment) level, which can be aggregated based on addresses and industrial codes. Using address data, the establishment can be located by county or, using the zip (postal) code located within counties to shore-adjacent areas. Geocoding of establishments by latitude and longitude has also begun, permitting more flexible measures of geography though use of geocoded data lies in the future.

As noted, the most widely used measure of market flows of value is the gross domestic product. For purposes of estimating these values in the U.S. ocean economy, the the gross state product (GSP) is used. GSP is conceptually related to GDP but has several advantages for the estimation of ocean values. Defined as the total value of the output of goods and services, GDP must be estimated on a value-added basis to avoid double counting production. GDP normally does this by valuing production at the point of final demand. Thus GDP is defined as the value of consumption plus investment plus government purchases of goods and services plus net exports (exports minus imports). For example, the value of fisheries is measured at their point of final consumption by consumers in retail markets or restaurants. That value includes the value added by the fish harvester, fish processor, transportation, and final preparation for sale.

However, the estimation of the ocean economy proceeds from a different basis. The definition of the ocean economy is based on the inputs to the production process, and thus a production, as opposed to a consumption-based, definition is needed. In addition, the estimation of the ocean and coastal economies are geography specific, and must be built from the local level up to the national level.

Gross state product meets both these needs. It is based on the output (value added) by industry in each state, and is a more geographically specific measure of output than is GDP. Measures of value added are not available below the state level, however, and so the state level estimates must be disaggregated to the establishment level and then reaggregated to form the estimates of coastal and ocean output. This is done by assigning each establishment a share of GSP appropriate to its state and industry based on wages paid by the establishment.

The NOEP market data for the ocean and coastal economies provides a nationally consistent estimate of output, employment, and wages. It can provide totals at the national, state, or county levels, and can be divided to show economic activity in watersheds, the coastal zone (as defined by federal law), and in the near shore area (defined by coastal zip codes) for thirty coastal states, including those bordering the Great Lakes. It shows data for six of the eight sectors. (The measurement of the scientific research and government sector cannot be done with QCEW data, and requires additional analysis beyond the resources available to date.) At the state and national levels, it also measures sixty five industries defined as part of the ocean economy. Industry level detail below the state level is not published because of confidentiality restrictions.

Data is currently available for 1990, 2000 and 2001 on an SIC basis, and for 2001 on a NAICS basis. Data will be available for 2002 by the end of 2004. In 2005, the years between 1990 and 2000 will be estimated, and 2003 will be completed. All estimates after 2001 will be on a NAICS basis only. This will yield data for the period from 1990-2003. The Project is working with the Bureau of Labor Statistics and NOAA to continue producing data on the ocean and coastal economies as part of regular federal statistical series beginning in 2006.

The second element in the NOEP approach is to build a data base of measures of the ocean economy that are supplemental to the core measures of output, employment, and wages. Examples of such data include: fisheries landings by weight and value, oil and gas

production volumes and values, cargo movements and passenger embarkations/ debarkations at key ports, recreational boat registrations in coastal regions, visitor day counts for recreation resources, etc. Some data (for example fish landings and cargo movements) are collected on a regular basis under national standards; others such as visitor day counts are highly irregular.

The purpose of collecting these measures is that they provide a more complete description of ocean and coastal economic activity, and are often of particular interest to policy makers. To date, the Project has collected this data for two regions, the Long Island Sound and for California.

The third element of the NOEP is to develop better ways to use non-market data on ocean and coastal resources. Unlike the measurement of employment or output, there are no standard measures of non market values. Rather there are a multitude of studies conducted at different locations, at different times, and often using very different methodologies. The large variance in methodologies and the controversies surrounding some of them such as contingent valuation (a survey-based method of identifying values) creates a much more difficult environment in which to try to deal with the measurement of flows of non market values.

The first order task therefore is to try to bring some order to the chaos of studies and values that exist. This will involve developing a taxonomy which can be used to classify studies according to topic, resource, region, methodology, data sources, theoretical approach, etc. The taxonomy can then be used to order existing studies and to aid analysts and researchers in using existing data sets for benefits transfer (using measures taken in one region for other areas in the absence of specific studies of those areas). The taxonomy will also allow a more systematic research plan to be developed to guide future collection of non market values of ocean and coastal resources.

What lessons does the American experience hold for Canada?

The approaches taken so far by the U.S. National Ocean Economics Project can be replicated in Canada. The basic structure of data used in the U.S. analysis also exists in Canada. Employment and wage data is collected through the Statistics Canada Survey of Employment, Payroll, and Hours and is comparable to the Quarterly Census of Employment and Wages in the U.S. The Canadian survey contains data on hours worked that is not available in the U.S. data and could thus provide a more detailed picture of full and part time employment in ocean industries. Statistics Canada also produces estimates of provincial gross domestic product comparable to the gross state product figures used in the United States.

There is also geographic comparability in the U.S. and Canadian systems, although there may be some differences that could require modifications in the analysis of Canadian data. Data is available for sub-provincial regions on all of the provinces. Unlike the U.S. where the county is the standard statistical measure below the state level, not all provinces in Canada have regions called counties. Newfoundland and Labrador as well as British

Columbia define their sub-provincial regions simply as districts. The classification of these sub-provincial districts by natural features (such as inclusion within a coastal watershed) is unknown.

Address data on the Survey of Employment, Payroll, and Hours records should be sufficient to construct a "near shore" category similar to the U.S. data, although there may be some differences between the construction of Canada Post's postal code system and the U.S. Postal Service's zip codes which would require attention. It is not known whether Statistics Canada is implementing geocoding on the address records of the Employment survey.

The definitions of ocean economy industries and sectors are easily comparable as both the U.S. and Canada use the North American Industrial Classification System for data from 2001 on. One advantage Canada has over the United States is that data on employment and wages in the fisheries harvesting sector is more complete and consistent than in the U.S. Harvesting sector employment and wages are excluded from the U.S. data series because this sector is not required to meet the same reporting requirements as other industries.

As with the U.S. project, decisions will have to be made about the precise geography to include in the "coast". For Canada, a major question will be how far up the St. Lawrence River to define as coastal and whether to include the Great Lakes. (The Great Lakes are included in the U.S. data.) Other questions may include whether there is an "inland" Nova Scotia that is excluded, and how to treat the economies of the northern territories bordering the Arctic sea. These questions admit to no clear cut answers and are inevitably addressed with a certain arbitrariness.

Canadian efforts to replicate the U.S. work in construction of ocean and coastal market data will also have to confront issues of protection of confidentiality. In neither country can data be released that would identify the specific information for an individual respondent. Specific procedures are required to prevent the disclosure of confidential data including the suppression of data that could be used to infer the data for individual respondents. Standards for the protection of confidential data are similar in both countries, but there may be differences in specific cases as to what can and cannot be released.

One question to which the answer is unknown at this point is Statistics Canada's policies with respect to access to its establishment level records for purposes such as those discussed here. In the U.S., access to the confidential establishment records is highly restricted, though it is possible to gain access following an intense review of the scope of work, background checks on researchers, etc. Once access has been granted, however, there is no cost to the researcher for the data, at least at the Bureau of Labor Statistics. (A fee is charged for access to confidential data at the Bureau of the Census). In contrast to U.S. practice, Statistics Canada has a general policy of charging for its data, even the publicly available data series which are almost always free in the U.S. A full understanding with respect to Statistics Canada's policies regarding access to confidential data and their charges (if any) for doing so would be essential.

The other two elements of the U.S. work are also easily transferable to the Canadian context. Data on the production values and quantities of a variety of ocean resources are available from both federal and provincial sources and need only be compiled into a common data base for access. Research on non-market values of Canadian ocean and coastal resources can also be organized in a manner similar to that being undertaken by the NOEP. In this regard, it may be desirable not to undertake a separate effort in Canada. Canada and the U.S. have already begun cooperative efforts to manage non-market data on environmental resources through the Environmental Valuation Resource Inventory (EVRI), a joint project of Environment Canada and the Environmental Protection Agency to build a bibliographic data base on economic studies of environmental resources, which currently has very limited information related to ocean and coastal resources.) In the non market area there are no major differences between Canadian and U.S. data sources.

The cost and timing of undertaking a Canadian project similar to the NOEP cannot be reliably estimated without more information about such as issues as Statistics Canada's policies on data. For reference, the NOEP costs over the period from 1999-2004 total approximately $US1.2 million. This has covered research design and planning, the creation of the market data through 2002, the development of a website and database for access to the data, and administrative/overhead costs. The development of the market data base took about 8 months of full time work spread over a three year period. Because confidential data was used, all work had to be performed on site at the Bureau of Labor Statistics in Washington.

Finally, it should be noted that the NOEP methodology for identifying and measuring market values is still at an early stage. There are a number of known imperfections in the data, and methodological development will be continuing over the next several years to improve the quality of the estimates.

What about the economic value of natural capital?

As noted, the current approach of the U.S. NOEP is directed at the measurement of flows of values created by the ocean and coastal resources. There are two major aspects to the valuation of the stocks of resource assets that are missing: the value of coastal real estate and the value of capital assets such as fisheries and mineral resources.

The value of coastal real estate is a very significant value which is measured in the national income accounts only in the increments to the stock of developed real estate each period. Measurements of the total stock of coastal real estate value are not undertaken. But it is clear that the value of coastal real estate is significant. It is well known that shore frontage property, or even property with views of the oceans or other water bodies command substantial premiums in price. This premium shows up in housing prices and even in the premiums demanded by hotels for "ocean view" or "partial ocean view" rooms. These amenity values are captured in market prices, but cannot be separately identified except through a very data- and analytically-intense process that has been well beyond the current scope of available resources.

The stock, or capital, value of natural resource assets such as fisheries and minerals presents a different set of challenges. Much work has been done in this area in Europe and North America, and methods for valuing capital stocks of some resources are increasingly being used. Foremost among these are minerals and forest resources. Estimating the capital values of these resources requires detailed information on the flows of current and projected values. Such data has not heretofore been available on a nationally consistent basis for such industries as offshore oil and gas production. It is hoped that as the NOEP data series are developed and refined, it will become possible to develop stock value estimates for the minerals industries.

The estimation of other stock values is more difficult. It would clearly be desirable to estimate the value of key recreational assets such as parks, shore front paths, boat launching facilities, marinas, beaches, and "shore access points" which are prevalent in many locations as ways to access the shore through or around private property. There is little reason to doubt that the non market values of such amenity assets is substantial. But without good data on the number of people using these resources, or a consistent measurement of the values they place on the amenities, it is not possible to derive useful estimates.

The stock values of fisheries present another set of considerations. The decline in commercial fishery populations and the mandated reductions in fishing effort in both countries needed to restore populations represent a net loss in economic welfare. But measuring that decline has proved to be very difficult. There are both theoretical and methodological reasons for these difficulties, a full exploration of which is beyond the scope of this paper.

Briefly, however, the principal issues lie in the fact that fisheries are a common property resource whose value is determined at the time of capture and sale. The value of the fish stock is the present value of future flows of fishery harvests, which can only be known if it is possible to predict the actual level of those harvests. But information on the future size of fish stocks is highly imperfect, particularly given the presence of management regimes whose effectiveness is itself unknown. There have been a number of attempts to estimate capital values for fish stocks, all of which must control for uncertainties in fish population sizes and future prices and costs of harvesting (the net of which is the economic value derived from any level of fishing effort) by making assumptions about future population size and economic values. In such cases, the results are essentially determined by the assumptions needed to resolve critical unknowns rather than being accurate estimates of capital values themselves.

To be sure, there are assumptions about the future inherent in all capital stock valuation and the difficulties inherent in estimating the capital stock of coastal recreation amenities or commercial fisheries should not be seen as absolute barriers to attempts to undertake such estimation. However, those difficulties suggest that the tasks of estimating capital stocks should follow the creation of reliable data on the values of flows of value from ocean resources in efforts to create nationally consistent estimates of ocean values.

Recommendations

Two major reviews of U.S. ocean policy, one conducted by a commission appointed by the Pew Charitable Trusts and other created by the U.S. Congress, have pointed to the importance of a much expanded and improved understanding of the economic values of ocean and coastal resources as an essential part of sustainable uses of those resources. The U.S. Ocean Commission established by Congress noted in particular the current severe lack of data in many key areas and recommended a substantial expansion of efforts by NOAA and other federal agencies to fill the data gaps.

Canadian ocean and coastal policy faces challenges that are very similar to those faced in the United States, and also faces the same issues with respect to the lack of data about the ocean economy. In dealing with those issues, Canada has some important advantages. The data needed to fill the gaps in understanding of ocean and coastal economies is available on approximately the same basis as in the U.S. Questions of access and cost need to be resolved, but there are no inherent limitations to Canada's undertaking a similar effort to that underway in the U.S. through the NOAA-NOEP partnership. Moreover, the work already underway in the U.S. has already begun to develop the methodologies needed to estimate, assemble, and distribute the needed data, thus providing a foundation for Canadian efforts.

If the National Roundtable wishes to pursue the development of economic information pertaining to the oceans and coasts in order to better understand and predict the interactions of economic and environmental change, there are ***two broad options*** available. One would be to replicate for Canada the development of a set of ocean and coastal economic accounts for the market-based economic values and to examine the role of estimates of non-market values for Canadian resources. To do this, the National Roundtable should:

1. Review the different definitions of economic value and decide which should receive emphasis. This step should define the long term goals of economic research on ocean and coastal resources. The goals selected may be similar to those of the U.S. efforts, but there may be other goals particular to Canada that should be included.

2. Discuss with Statistics Canada the possibility of duplicating the analysis of standard data series in a manner similar to that undertaken by the NOEP. Issues of access and cost must be resolved early.

3. Identify resources in Canada that may be able to undertake the work. The government-university partnership in the U.S. is one model, but it may not be appropriate in the Canadian institutional context. Possible connections to U.S. resources, including the National Ocean Economics Project, should be assessed.

4. Develop a multi-year research strategy that will achieve the outcomes defined in step 1 in collaboration with the research resources identified in Step 3.

5. Based on the overall research strategy and goals, develop specific program and budget recommendations for the Government to consider in the appropriate policy and budget cycle processes.

The second option would be to undertake studies on a more limited scale in order to examine issues of high priority and to develop capacity for economic data collection and analysis in the context of management of coastal and ocean resources. To undertake this approach, the Roundtable should identify one or two high priority policy issues where a significant but limited effort to identify and measure the links between environmental and economic change would be of benefit.

In order to provide a foundation for future development of economic information, the choice of research areas should offer the opportunity to break new ground in both measurement methodology and subject. For example, issues of fishery management have been perhaps the most thoroughly studied Canadian ocean resource from an economic perspective. While the knowledge base for these issues is far from perfect, additional studies of fisheries economic issues would probably not break new ground in showing how a mutual understanding of economic and environmental change would be beneficial.

The choice of subject for a more limited approach should provide the opportunity to examine a single issue across multiple regions in order to highlight the issue from a national perspective, but also to demonstrate how an understanding of regional variations in the issue may be required for effective national policy. A good example of a topic that meets these requirements is the study of the size and changing role of tourism and recreation in the ocean and coastal economy.

The topic of coastal and ocean tourism and recreation would have several advantages.

- The growth in this sector was identified in the U.S. studies as by far the most significant among the market-based values for the ocean economy. Canada is likely to be different in degree in growth but not in kind.

- The large growth and generally land-intensive nature of tourism and recreation growth along the coasts can place a significant strain on coastal resources such as shorelines and wetlands.

- Understanding the role of the economic value of tourism and recreation requires examination of both market and non-market values and so can show how a complete understanding of ocean economic values is important.

- Tourism and recreation growth in coastal areas is important in both urban and rural areas. It is an increasingly important part of the attraction and quality of life in urban areas (e.g. Vancouver), but also a critical growth opportunity for rural areas whose other natural resource economies are under strain.

- Tourism and recreation market data can likely be easily developed through an application of the NOEP methodologies to Canadian data series.

Other sectors which also might be examined include the minerals and transportation sectors. The minerals sector, like fisheries, is also extensively studied with respect to the oil and gas industries, but the role of other minerals industries such as sand and gravel mining are generally not well understood. The ocean-related oil and gas industry is also easier to measure in Canada than in the United States since the production, at least in the Atlantic Provinces, is exclusively offshore. (American states such as Texas and California have extensive onshore and offshore activities making separating the two sources of economic activity difficult in the standard statistical series.)

Marine transportation studies could examine the role of both passenger and cargo movements. Marine passenger transportation, including the roles of ferry systems, are also an under-studied field, and the rise of the cruise ship industry has had positive effects of an unknown magnitude. To fully measure the economic role of marine freight transportation requires extending the analysis beyond that which is currently being done in the U.S., since the principal value is created to transportation-using industries and consumers rather than transportation producing industries.