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Contribution of the Ocean Sector to the United States Economy

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It is usually possible to discern the progress achieved and also the difficulties not yet overcome at different periods in the development of fields of inquiry by examining the technical tools which are used contemporaneously (1).

We report here on a project that has led to the creation of a new subdivision within the national income accounting system (NIAS). This subdivision divides gross national product (GNP) into two parts: an ocean sector and an all-other component (*2*). In 1972, with the GNP of the United States some $1171.1 billion, the aggregate value of the ocean sector was $30.6 billion. Although this number may at first glance seem small, it is roughly comparable to such industries as agriculture, mining, transportation, and communications.

In this article we describe the methodology and the calculation of the value of the ocean sector and its several subsectors (fisheries and coastal zone, for example) and address a number of specific interrelated problems:

1) The need to develop the statistical underpinning for the analysis of our ocean activity. This need stems primarily from the several pieces of legislation passed in the 1970's that involve substantive intervention by government in economic markets involving ocean economic activity (*3*).

2) Evaluation of the manner in which the value of government activity is measured within the NIAS. This is particularly important in the ocean sector where government accounts for the size of the sector (roughly one-third), and where government regulation has a major impact on the allocation of resources in numerous subsectors.

3) To suggest a methodology that may extend the utility of the NIAS in certain regional and natural resource problem areas, for example, ocean and agricultural policy.

4) The need to review the importance and the implications of the microeconomic theory underlying the NIAS for the measurement of economic activity, especially in the areas where market prices do not exist.

The new account measures the contribution of the ocean sector to the GNP, and is the first within the NIAS to be defined essentially on a spatial rather than a production sector basis. The ocean sector account measures both the aggregate contribution of the ocean to the GNP and the relative value of the several subsectors of the account, such as fisheries, transportation, and mining. Creation of the account may lead to model building that will analyze the linkages between the ocean sector and the rest of the economy. Such efforts would contribute to the U.S. ocean policy.

Why do we need an ocean policy, and what role, if any, would the ocean sector account in the NIAS play in the development of such policy? Although there is no simple answer we have shown previously that there is an economic need for such policies (*4*, *5*). The bases for the political and legal need are to be found in reports of the Stratton Commission (*6*), the Senate Commerce Committee (*7*), and in reports of the annual meetings of the Law of the Sea Institute, and the De-

Summary. The national income accounts have been reorganized to estimate the contribution to the gross national product of the ocean sector and its various subsectors for the year 1972. The new account is the first within the national income accounts to be organized along geographic, rather than productive, sectors. If properly updated and disseminated, this new account will give government and business interests a solid and consistent data base to measure, and choose among, the alternative uses of the oceans.

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partment of Commerce (*3*). However, the most compelling evidence of the need for ocean policy is provided by the legislation passed in the 1970's. All of this legislation supports a role for government in ocean affairs. The Fishery Conservation and Management Act of 1976; Mammals and Non-Migratory Birds—The Marine Mammal Protection Act of 1972; Coastal Zone Management Act of 1972; Endangered Species Act of 1973; Marine Protection, Research, and Sanctuaries Act of 1972 (*3*) and others are clear indications of a national commitment to regulation of the markets for the output from the ocean sector.

Three other issues were also studied. One of these was the methodology which we expect may lead to an improvement in the utility of the NIAS and to the creation of other new sectors, such as an agricultural sector and regional sectors.

A second issue was concerned with a review of both the empirical and theoretical (*8*) problems in the microeconomic theory that provides the foundation for the use of the national income data for the evaluation of economic importance. This issue has been considered previously (*9*); however, since it is essentially an exposition of the state of the theory of welfare economics underlying the NIAS, it is not included in this article. Walrasian general equilibrium theory specifies the conditions that justify the use of market prices (and the associated flows of commodities) to evaluate economic activity. National income systems are intended to measure these flows and their associated prices and quantities.

The third issue relates to an examination of the disparity between the values assigned public and private economic activity. Essentially, this is a review of the implications of the current method of accounting for the role of government in economic life, a set of conventions that still maintains the basic assumption in the original formulation of the NIAS that government is a precursor of economic activity, not a part of it.

Purposes and Objectives of the NIAS

The development of double-entry bookkeeping was a central element in the rational calculus of revenue, cost, and profits that accompanied the expansion of trade and commerce in the latter Middle Ages. The emergence of national states from the disintegration of the world vision of Christendom led to similar attempts to measure the wealth of individual nations. Beginning in the 18th century, efforts at measurement sought to unravel the linkages between the flow of trade and the stock of wealth of a nation: Was England or France getting richer or poorer as a result of its international trade and other economic activity? (*10*).

Over the next three centuries, numerous attempts were made to solve the problem of measuring income and a number of alternative views or definitions were developed. In particular, the conceptual framework for measuring income came to embody three fundamental properties: an aggregate accounting system that would apply to a nation as a whole; the income concept should reflect the economic well-being or welfare of

Table 1. Alternative measurements of GNP. Items indicated by X show the methods actually used by the Department of Commerce in measuring GNP. A Y indicates methods that are theoretically correct but not utilized; P is the methodology for the ocean sector. All measures currently used are provided both on quarterly and annual bases.

Dollars	Expenditure* ($C_t + I_t + G_t = GNP_t$)	Value added† $\sum_{i=1}^{m}$ (sales-inputs)$_{it}$ = GNP_t	Factor flow (Eq. 3)	Functional measurement of ocean sector plus all other‡
Constant dollars	X	Y	X	P
Current dollars	X	Y	X	P

*t = time. †i = GNP sector. ‡Sector = GNP.

Table 2. Definition of an ocean sector value added in the U.S. economy in an $n \times 2$ dimensional (product × spatial) sector system where a_{ij}, $i = 1,2, \ldots, n$; $j = 1,2$ is the value added originating in the ith product sector and the jth spatial sector. This yields the following consistency conditions:

1. $a_{01} = \sum_{i=1}^{n} a_{i1}$
2. $a_{02} = \sum_{i=1}^{n} a_{i2}$
3. $a_{i0} = a_{i1} + a_{i2}$, $i = 1, \ldots, n$
4. $a = \sum_{j=1}^{2} a_{0j} = \sum_{i=1}^{n} a_{i0} = GNP$

The consistency conditions are as follows. Our concern is with the value of a_{01} (the value of output in the ocean sector). The conditions imposed by the NIAS are as follows: (i) For each spatial sector, the sum of the amounts of each product sector allocated to that spatial sector must be the total product of that spatial sector. (ii) For each product sector, the sum of the product allocated to each spatial sector must sum to the total for the product sector. (iii) The sum of the value of production in each spatial sector must be equal to the sum of the product sectors, that is, GNP. The GNP must be invariant to any division or creation of sectors within the accounting system. Conceptually, these conditions require that the spatial definition on which division of the accounting system rests must be consistent across all product sectors. That is, whatever geographic or accounting rules and conventions are used to divide activities into an ocean and an other-than-ocean spatial sector for one product sector (say, government) must be the same for other product sectors (transportation, for example).

GPO sectors	Spatial sectors		
	Ocean sector 1	Other than ocean sector 2	Sum
1	a_{11}	a_{12}	a_{10}
2	a_{21}	a_{22}	a_{20}
⋮	⋮	⋮	⋮
n	a_{n1}	a_{n2}	a_{n0}
$n = 66$	a_{01}	a_{02}	$a = GNP$

Table 3. Definition of an ocean sector value added in a 2 × 2 (product and spatial) sector system.

Product sector	Spatial sector		
	Ocean sector (1)	Other than ocean sector (2)	Sum
Product originating in both spatial sectors	a_{11}	a_{12}	a_{10}
Product originating in spatial sector 2 only	$a_{21} = 0$	a_{22}	a_{20}
Sum	a_{01}	a_{02}	$a = GNP$

the individuals in society (*11*); and in most cases, only economic activity taking place within the marketplace would be included (*12*).

At present, the NIAS measures the economic value of output and income. Change and variation in the flow of income leads to analysis of the growth and productivity of the economy, business cycles, and the crucial questions of employment and inflation. The NIAS accepts the existing distribution of income and, given a set of assumptions concerning the nature of competition in the economy, essentially accepts the conclusion that the composition of output is optimal. It also assumes that if the system is divided into three sectors—household, government, and business—only the business sector is productive. This assumption has complex philosophical and ideological roots, but its empirical justification rests on a property of the measurement system itself. Output from the business sector is exchanged in markets, and these markets are assumed to be reasonably competitive. Therefore, the observed price and quantity vectors associated with aggregate output approach the optimal ones suggested by economic theory as yielding the "best" or most efficient allocation of resources. Conversely, the activities of households and government are not priced in the market and, therefore, can only be valued at the cost of the labor input.

A further property of the NIAS is that it defines a set of variables that describe the economic system. Thus, we have measures of the flow of consumption, investment, government expenditure, a rate of savings, and price indices. The definition and measurement of such variables provide the basis for analytical systems that describe and forecast the behavior of the economic system with particular focus on economic growth and business cycles.

Creation of an Ocean Accounting Sector

Consistency conditions. In order to measure the value of the contribution of the oceans to the GNP of the United States, the measurement must be consistent with the NIAS. Commonly made measurements of the value of partial activity, the role of a Port Authority, the contribution of tourism, or the value of fisheries, for example, almost inevitably are incorrect. If they are aggregated, separate measures of partial activity will not add to the GNP (*13*). Consistency requires that the measurement of all partial activity add to the GNP.

Therefore, our question becomes whether it is possible to create a spatial subsector within the framework of the existing accounting system. Our hypothesis is that the existing accounting system contains within it a place for an ocean sector and that this ocean account may be regarded as a step toward filling

Table 4. The GPO sectors within the ocean sector. The criteria for including various BEA divisions and GPO sectors in the ocean account are as follows. p, Partial, not all activities of the particular SIC industry in ocean sector. If two-digit industries contain subgroups which do not have any activity within the ocean sector, then only the appropriate three or four digit industry is included. S_1, Extractive. The primary activity of the establishment involves extraction of living or inanimate objects from the ocean. S_2, Spatial. The primary activity utilizes ocean water as a significant element in the productive process; or the primary activity of the establishment involves some manner of transportation of passengers, cargo, natural resources, or electrical impulses upon or below the ocean surface. D_1, Complementary. Demand for a significant portion of the establishment's output is attributable to the ocean. D_2, Geographic. The establishment is located within a region proximate to the ocean. S_{2g}, Spatial. The agency in carrying one or more of its functions utilized ocean water as a significant element of its production process; or, a function of the agency involved some manner of transportation of passengers, cargo, personnel, or natural resources upon or below the ocean surface. D_{1g}, Complementary. A significant portion of the agency's functions are devoted to the development, management, or regulation of coastal zone or ocean resources; or, the agency is involved in marine education or research, or in monitoring of the oceans or the coastal zone.

Major BEA division	GPO sector	Included SIC industries in ocean sector		Criteria
Agriculture, forestry, and fisheries (division A)	Agricultural services, forestry, and fisheries (SIC 07-09)	091p	Commercial fishing	S_1
Mining (division B)	Crude petroleum and natural gas (SIC 13)	13p	Oil and gas extraction	S_1
	Mining and quarrying of nonmetallic minerals (SIC 14)	1422p	Crushed and broken limestone	S_1
		144p	Sand and gravel	S_1
Construction (division C)	Construction (SIC 15-17)	162p	Heavy construction except highway and street construction	S_2, D_1
Manufacturing (division D)	Transportation equipment, except motor vehicles (SIC 372-379)	373p	Ship and boat building	D_1
Transportation, communications, electric, gas, and sanitary services (division E)	Motor freight and warehousing (SIC 42)	422p	Public warehousing	D_1
	Water transport (SIC 44)	441	Deep sea foreign transportation	S_2
		442	Deep sea domestic transportation	S_2
		445p	Local water transportation	S_2
		4463p	Marine cargo handling	S_2
		4469p	Water transportation services, not elsewhere classified	S_2
	Telephone and telegraph (SIC 481-2, 489)	481p	Telephone communication (wire or radio)	S_2
		482p	Telegraph communication (wire or radio)	S_2
Retail trade (division G)	Retail trade (SIC 52- 59)	52p	Building materials, hardware, garden supply and mobile home dealers	D_2
		53p	General merchandise stores	D_2
		54p	Food stores	D_2
		55p	Automotive dealers and gasoline service stations	D_2
		56p	Apparel and accessory stores	D_2
		57p	Furniture, home furnishings, and equipment stores	D_2
		58p	Eating and drinking places	D_2
		59p	Miscellaneous places	D_2
Finance, insurance, and real estate (division H)	Insurance (SIC 63)	633p	Fire, marine, and casualty insurance	D_2
	Real estate and combinations (SIC 65-66)	65p	Real estate operators	D_2
		66p	Combinations of real estate, insurance loans, and law offices	D_2

out the matrix of accounts that constitute the economy.

The ocean sector account is created as follows: Theoretically, GNP may be measured in terms of expenditures, value added in the economy, or by aggregation of the flow of factor incomes (Table 1). Given the existing system and the addition of the ocean sector, we may write: in terms of expenditures (see Table 1, column 2)

$$\begin{aligned} C + I + NF + \\ 733.0 + 188.3 + (-3.3) + \\ GE = GNP \\ 253.1 = 1171.1 \end{aligned} \quad (1)$$

in terms of value added (see Table 1, column 5)

$$\begin{aligned} O + AO = GNP \\ 30.6 + 1140.5 = 1171.1 \end{aligned} \quad (2)$$

where C is aggregate consumption, I is private domestic capital formation, NF is the value of imports less the value of exports, GE is actual expenditures by government, O is the value of the ocean sector, and AO is the value of the rest of the economy, with all data being for 1972.

These procedures are indicated in Table 1, where the creation of an ocean account represents the addition of one column to this system. Other columns could be added in order to focus on specific economic problems where improvement in the measurement of economic value may help in decision-making.

We define our process of ocean sector creation as a two-dimensional spatial and product reorganization of the macroeconomic system as defined by current NIAS methodology.

Table 2 shows an $n \times 2$ dimensional breakdown of the national income accounts. Consistency within the framework of the accounting system is maintained with the system subdivided into two spatial sectors (ocean and all other than ocean). The traditional approach used in structuring the national income accounts has been to have spatial unity (the United States) and, for purposes of analysis, division into production sectors (business, households, government), usually defined by function or sectors, or both, referred to as gross product originating (GPO) sectors.

Operational guidelines. The consistency conditions must be supplemented by a set of operational guidelines that enable us to define and separate out the constituent elements in each product sector that belong in the ocean sector.

Table 1 indicates the techniques that are used to calculate GNP: (i) aggregating consumption, investment, and government expenditures; (ii) aggregating the value added totals of each product sector (defined as receipts less expenditures on intermediate inputs); and (iii) aggregating factor payments, capital consumption allowances, and other direct and indirect business expenses attributable to each sector. The third alternative serves as the primary operational methodology in the Department of Commerce's construction of the national income accounts:

$$GNP = \sum_{i=1}^{N} (L_i + \pi_i + r_i + X_i + D_i) \quad (3)$$

where i represents the product sectors as defined by the Department of Commerce, L is total employee compensation, π is total profit-type income, r

Table 4 (continued).

Major BEA division	GPO sector	Included SIC industries in ocean sector		Criteria
Services (division I)	Hotels and lodging places (SIC 70)	70p	Hotels, rooming houses, camps, and other lodging places	D_2
	Motion pictures (SIC 78)	783p	Motion picture theaters	D_2
	Amusement and recreation services, except motion pictures (SIC 79)	799p	Miscellaneous amusement and recreation services	D_2
	Educational services (SIC 82)	822p	Colleges, universities, professional schools, and junior colleges	S_2, D_1
	Membership organizations and social services (SIC 83, 86)	862p	Professional membership organizations	D_1
		864p	Civic, social, and fraternal organizations	D_1
	Miscellaneous professional services (SIC 84, 89)	84p	Museums, art galleries, botanical and zoological gardens	D_1
		891p	Engineering, architectural, and surveying services	D_1
		892p	Noncommercial, educational, scientific, and research organizations	D_1
Public administration (division J)	Federal general government		Soil Conservation Service	D_{1g}
			National Oceanic and Atmospheric Administration	S_{2g}, D_{1g}
			United States Army	D_{1g}
			United States Navy	D_{1g}, S_{2g}
			Army Corps of Engineers	D_{1g}
			Bureau of Land Management	D_{1g}
			Geological Survey	D_{1g}
			Maritime Administration	S_{2g}, D_{1g}
			Bureau of Sport Fisheries and Wildlife	D_{1g}
			National Park System	D_{1g}
			Office of Saline Water	D_{1g}
			United States Coast Guard	S_{2g}, D_{1g}
			Saint Lawrence Seaway	S_{2g}, D_{1g}
			Environmental Protection Agency	D_{1g}
			National Aeronautics and Space Administration	D_{1g}
			National Science Foundation	D_{1g}
			Federal Maritime Commission	D_{1g}, S_{2g}
			Smithsonian Institution	D_{1g}, S_{2g}
	State and local general government			D_{1g}, S_{2g}
Not applicable; enterprises classified in all ten (divisions A–J) BEA divisions	Federal government enterprises			D_{1g}, S_{2g}
	State and local government enterprises			D_{1g}, S_{2g}

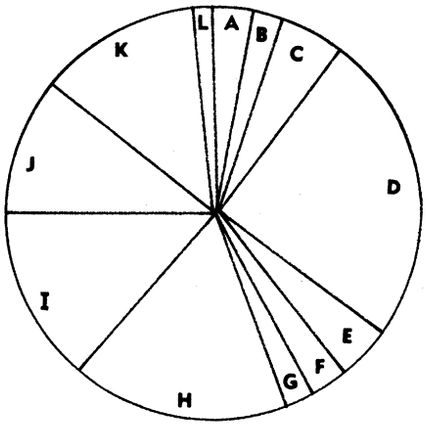

Fig. 1. GNP disaggregation by industry, where A is agriculture, forestry, and fisheries, 35.4 (3 percent); B is mining, 18.9 (2 percent); C is construction, 58.0 (5 percent); D is manufacturing, 288.8 (25 percent); E is transportation, 46.2 (4 percent); F is communication, 29.4 (3 percent); G is electricity and gas, 28.0 (2 percent); H is wholesale and retail trade, 201.2 (17 percent); I is finance, insurance, and real estate, 167.3 (14 percent); J is services, 134.5 (11 percent); K is government and government enterprises, 154.9 (13 percent); and L is the rest of the world and statistical discrepancy, 8.3 (1 percent); and the total is 1171.1 billion (100 percent).

is net interest payments, X is indirect business taxes, and D is total capital consumption allowance (*14*). L is the ith sector's total wage bill (including fringe benefits and social security payments) and π_i is accounting profit and includes what economists call economic profit as well as returns to other factors, rents and implicit returns on capital. From this income-flow definition of GNP we construct the criteria that are necessary for the measurement of the income flow for the ocean sector.

As a first approximation, we define ocean sector product as the aggregate factor payments (Eq. 3) of those establishments within the 66 GPO sectors that either utilize an ocean resource in a productive process (supply-side criterion), or exist because the demand for the establishment's final output is due to some attribute of the ocean (demand-side criterion). The algorithm for selecting those establishments which compose the ocean sector is as follows: we link the previously introduced supply-side and demand-side criteria that define establishments within the ocean sector with the central characteristic of the standard industrial classification (SIC) code—the primary activity of each establishment in the 66 GPO sectors.

Table 5. The GNP and the ocean sector by industry for 1972. Dollar amounts are given in billions.

Industry	U.S. total		Ocean sector total		Ocean sector percentage of industry [(A/B) × 100]
	Industry contribution to GNP (A)	Percentage of GNP	Industry contribution to ocean sector (B)	Percentage of ocean sector	
Agriculture, forestry, and fisheries	$35.4	3	$0.3	1	0.8
Mining	18.9	2	2.1	7	11.1
Construction	58.0	5	0.2	1	0.3
Manufacturing	288.8	25	1.3	4	0.4
Transportation	46.2	4	2.4	8	5.2
Communication	29.4	3	0	0	0.0
Electric, gas, and sanitary services	28.0	2	0	0	0.0
Wholesale and retail trade	201.1	17	7.2	24	3.6
Finance, insurance, and real estate	167.3	14	4.7	15	2.8
Services	134.5	11	1.2	3	0.8
Government and government enterprises, total	154.9	13	11.2	37	7.3
General government, total	137.4	11	10.8	35	7.8
Federal	50.1	4	10.6	34	21.1
State and local	87.3	7	0.2	1	0.2
All enterprises, total	17.5	2	0.4	1	2.2
Federal	8.7	1	0.2	1	2.2
State and local	8.8	1	0.2	1	2.2
Rest of the world	7.0	6	0.0	0	0.0
Statistical discrepancy	1.3	0	0.0	0	0.0
Total	1,171.1	100	30.6	100	2.6

Each establishment is defined within the SIC code by its primary activity. If that primary activity meets at least one of the following criteria, then that establishment, and thus at least a portion of the value-added of that GPO sector, is to be included within the ocean sector. We construct both supply-side and demand-side criteria for determining the composition of the ocean sector because the attributes of the ocean can affect an establishment's GPO total by either inducing demand for the establishment's output, or by reducing the cost of production by utilizing inputs from the ocean. Thus, to capture all influences of the ocean on gross product, we construct both supply-side and demand-side criteria.

Supply and Demand

Formally, the value of the output of an establishment is included in the ocean sector if the primary activity of the establishment meets one or more of the following criteria:

Supply-side criteria. These include S_1, or extractive, in which the primary activity of the establishment involves extraction of living or inanimate objects from the ocean, and S_2, or spatial, in which the primary activity utilizes ocean water as a significant element in the production process, or the primary activity of the establishment involves some manner of transportation of passengers, cargo, natural resources, or electrical impulses upon or below the ocean surface.

Demand-side criteria. These include D_1, or complementary, in which demand for a significant portion of the establishment's output is attributable to the ocean, and D_2, or geographic, in which the establishment is located within a region proximate to the ocean as specified below.

Table 3 follows from this definition and shows the breakdown of the accounting system into ocean and nonocean sectors. Table 4 indicates how we link the underlying data to these criteria to derive an ocean sector from the accounting system. The first GPO sector is agricultural services, forestry, and fisheries. Underlying this concept of a GPO sector is a set of business establishments classified as indicated by the SIC codes. Examination of this set of establishments indicates that one subset, those establishments represented by SIC code "091p Commercial fishing," is, based on criterion S_1, part of the ocean sector. Since none of the other establishments in the sector meet this test, the rest of the GPO sector is therefore classified as all

other. This process is followed in all GPO sectors.

A major problem that remains is the division of the national income accounts into public and private sectors with only the private sector being considered productive. This public-private dichotomy was adopted in the 1930's as an integral part of the accounting system. At that time government made a much smaller contribution to GNP and the contribution was more heavily in what, for lack of better words, we may call purely government functions—diplomacy, defense, legislation, and judiciary. Since then, the role of government in the economy has undergone a major transformation. In terms of size, we may think of government as approximating up to half of GNP (this depends on how the contribution is measured, and we use this statement to suggest the degree of change rather than any precise measurement). Further, government is now much more heavily engaged in productive activity that is not distinguishable from the same activity in the private sector.

Our accounting system, however, is focused on the private sector, with the result that measurement and analysis of the contribution of government is considerably more difficult than for the private sector. In the accounting system there are, as indicated, 66 GPO sectors. Of those sectors, 61 report on the private sector, four on government, and only two represent the federal government. This imbalance barely indicates the nature of the statistical problem but it is suggestive of the greater difficulties involved in reorganizing the government sector into ocean and all other components. This lack of a strong empirical base for the analysis of government activity also hints at the source of some of the current dissatisfaction with the lack of control over government activities.

For national income accounting purposes, the data used to report on the federal government are labor expenditures by agency and by classification of workers by civil service grade. This reporting is of little use for the analysis of the nature of government activity. The data simply reveal that an agency had a given wage payment in each grade. Nothing is revealed about the functions performed by the agency or the location of the activity engaged in.

Unless we refer to other sources, none of which are inclusive of all aspects of government activity, we cannot know what the government is doing or where it is doing it. We know that it pays for labor services and what level of labor skills are involved, but again, we do not know the type of skills employed.

Within the framework of this project, we have two problems: (i) to identify the agencies involved in various ways in ocean activity and (ii) to calculate the proportion of the agency wage bill that represents its ocean activity if the agency in question is not exclusively engaged in the oceans. To approach these problems we apply to government agencies the definition used for the private sector.

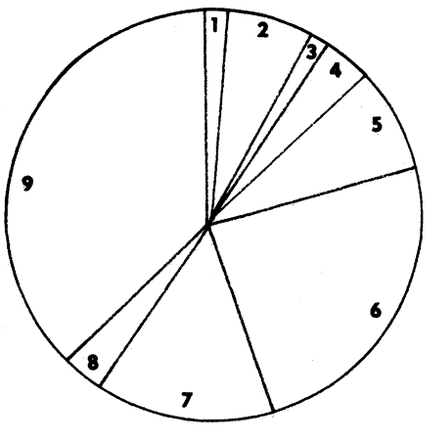

Fig. 2. Ocean sector disaggregation by industry, where *1* is agriculture, forestry, and fisheries, 0.3 (1 percent); *2* is mining, 2.1 (7 percent); *3* is construction, 0.2 (1 percent); *4* is manufacturing, 1.3 (4 percent); *5* is transportation, 2.4 (8 percent); *6* is wholesale and retail trade, 7.2 (24 percent); *7* is finance, insurance, and real estate, 4.7 (15 percent); *8* is services, 1.2 (3 percent); and *9* is government and government enterprises, 11.3 (37 percent); and the total is 30.6 billion (100 percent).

Table 6. Breakdown of the GNP by industry and by industrial subsectors, according to 1972 data, in billions of dollars.

Industry	U.S. total: industry proportion of GNP (dollars)	Ocean sector total: industry proportion of ocean sector (dollars)
Agriculture, forestry, and fisheries	35.4	0.3
Farms	32.0	0.0
Agricultural services, forestry, and fisheries	3.3	0.3
Mining	18.9	2.1
Oil and gas extraction	12.3	2.0
Mining and quarrying of nonmetallic minerals	2.3	0.1
Metals and coal	4.4	0.0
Construction	58.0	0.2
Manufacturing	288.8	1.3
Nondurable goods	116.9	0.0
Durable goods	171.9	1.2
Transportation	46.2	2.4
Water	2.7	2.2
Other than water	41.9	0.0
Services	1.6	0.2
Communication	29.4	0.0
Electric, gas, and sanitary services	28.0	0.0
Wholesale and retail trade	201.1	7.2
Retail	116.2	7.2
Wholesale	84.9	0.0
Finance, insurance, and real estate	167.3	4.7
Real estate	123.5	4.7
Finance and insurance	43.9	0.0
Services	134.5	1.2
Hotels, motels, and lodgings	6.9	0.7
Amusements and recreation	7.8	0.4
Education	7.3	0.1
Other	112.4	0.0
Government and government enterprises	154.9	11.2
General government	137.4	10.8
Federal	50.1	10.6
State and local	87.3	0.2
Enterprises	17.5	0.4
Federal	8.7	0.2
State and local	8.8	0.2
Rest of world	7.0	0.0
Statistical discrepancy	1.3	0.0
Total, by industry	1,171.1	30.6

This involves direct inquiry about agency activity, analysis of the program budget and expenditures by agency, and examination of the several government reports that over the years have focused on who is doing what in the oceans.

As a first approximation, we may summarize the central issues of these problems with respect both to the ocean sector account to the more general analysis of government, as follows:

In our opinion, it is desirable to further extend the incorporation of government into the GPO framework. This may be accomplished first by breaking down the data on expenditures on labor to include expenditures by function—in essence, to require of government the same level and sophistication of reporting and collecting of census data, for example, as is currently required of the private sector.

Second, if we assume that government will continue to carry on activities that have direct counterparts in the private sector, for example, garbage collection, we need to know what proportion of government these activities represent. We would then be able to compute in these cases (as is currently done within the framework of the accounting system in large areas of the private sector) a return on capital. Thus, we would divide government output in this initial stage into two parts: the fraction that has analogies in markets and that for which there is no market proxy.

This procedure would substantially clarify the microeconomic foundations of income accounting. That is, by breaking down government activity into production and regulation, for example, we could gain a clearer picture of government involvement in the economy. Further, this procedure would raise a problem that is central in understanding and analyzing the economic impact of government: the nature of the capital stock acquired, utilized, and controlled by government.

The Contribution of the Ocean to the Economy

The data (Tables 5 and 6 and Figs. 1 and 2) are in terms of value added. These data are an extension of the table traditionally used by the Department of Commerce to report the value added by major industrial sources.

In 1972 the ocean sector had a value of $30.6 billion. This is roughly comparable to agriculture at $35.4 billion (including fisheries), mining at $18.9, construction at $58.0, transportation at $46.2, and communications at $29.4.

While the relative magnitudes of items in the GNP statement are usually stable, the years since 1972 have seen considerable disequilibrium in the economy, and the relative prices of certain commodities, especially petroleum, have changed. This suggests that the relationship indicated for the earlier period may have suffered. It also indicates the need for a time series of the value of ocean output.

Within the ocean sector, the government, primarily the navy, accounts for approximately 35 percent of the total. Other major contributions are from retail trade, 24 percent, and real estate, 15 percent. These latter figures reflect the importance of the coastal zone for recreation, seasonal houses, and as a desirable place to live. In 1972, offshore oil and gas contributed some 7 percent of the total. Since then, the changes noted in relative prices have also been accompanied by a change in the relative importance of offshore and onshore petroleum resources, because onshore output has declined.

The data described open up the full range of analytic possibilities associated with national income accounting. One line of inquiry leads to model building and analysis of the links between the ocean and the aggregate activity. A second leads to the analysis of the direct regulatory process and poses such questions as What is the cost of management of any activity? and How does it compare with the value of output? The data also suggest a basis on which research and policy priorities may be established.

References and Notes

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12. S. Kuznets, *National Income and Its Composition, 1919-1938* (National Bureau of Economic Research, Washington, D.C., 1941), chap. 1, pp. 3-60.
13. For an example of the problems encountered in attempting to measure the contribution of a set of partial activities, see the so-called Nathan Report (7).
14. The nomenclature of the various factor flows is that of the Bureau of Economic Analysis as found in the computer print-out of the GPO sector income totals.

15. This work has been carried out jointly by researchers at the Graduate School of Business, Columbia University, and members of the staff of the Bureau of Economic Analysis, U.S. Department of Commerce. We thank the members of the staff of the BEA who helped us understand the mysteries of the accounting system, and to build this account, especially M. Marimont, R. Parker, and J. Gottsegen. This program could not have progressed without the help of J. Curlin. The New York Sea Grant Institute, the National Sea Grant Program, and the National Science Foundation provided financial assistance. We also thank all those who encouraged us to proceed with this project.