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Estimating the Economic Value of the Ocean in a National Income Accounting Framework

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Abstract

A key part of the effort to estimate the economic value of the ocean is to develop estimates of the appropriate values of the goods and services traded in the market economy. Such estimates should include the output of industries associated with the ocean, as well as other measures of economic activity, including income generated, employment, the number of firms, etc. Providing the information that permits seeing the economy of the ocean within the context of other economic activity requires preparing estimates that are consistent with the National Income and Product

Accounts (NIPA). The key component is Gross Product Originating (GPO) of each industry that uses the ocean and its resources.1 This paper discusses the issues involved in preparing such estimates and presents some preliminary findings based on 1997 figures. Future working papers will describe refinements of this data based on more detailed data, and the extension of these estimates to the regional level and the creation of a historical data series. When complete, comparisons will be possible over time and across industries and regions.

Estimating the Economic Value of the Ocean in a National Income Accounting Framework

Preliminary Estimates of Gross Product Originating for 1997

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1. Introduction.

A key part of the effort to estimate the economic value of the ocean is to develop estimates of the appropriate values of the goods and services traded in the market economy. Such estimates should include the output of industries associated with the ocean, as well as other measures of economic activity, including income generated, employment, the number of firms, etc. Providing the information that permits seeing the economy of the ocean within the context of other economic activity requires preparing estimates that are consistent with the National Income and Product Accounts (NIPA). The key component is Gross Product Originating (GPO) of each industry that uses the ocean and its resources.[1] This paper discusses the issues involved in preparing such estimates and presents some preliminary findings based on 1997 figures. Future working papers will describe refinements of this data based on more detailed data, and the extension of these estimates to the regional level and the creation of a historical data series. When complete, comparisons will be possible over time and across industries and regions.

The estimation of GPO, or value added, is the most appropriate way for measuring the economic value of the ocean in a national income framework since it avoids double counting output. Total sales cannot be used, since the sales of many industries are the purchases of other industries. Value added is the difference between total sales and the costs of material inputs. It is comprised of wages, profits, net interest, and indirect taxes. GPO is the statistic that permits the most consistent way of measuring the output of industries, and so allows comparisons among industries based on their actual size.

2. Defining Ocean Industries.

Table 1 shows the key industries which have been identified as potentially influenced by the ocean. The list of industries is derived from three sources:

The Bureau of Economic Analysis (1972) and Pontecorvo et.al (1980 and 1987). These three previous studies focused on key industries using ocean resources based on whether the industry was related by Supply (inputs) or Demand (outputs).

Luger (1992). This study of the economic value of the coastal zone divided industries into coastal-dependent, coast-linked, and coastal service industries depending on how closely tied the industry is to direct use of ocean (coastal) resources.

The Economic Census of 1997. This Census (actually a series of surveys conducted by the Bureau of the Census and the Department of Agriculture) was used as the basis for the preliminary estimates presented here. The Economic Census provided data at significantly

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[1] A more complete discussion of the national income accounts and their relationship to ocean economic values can be found in the *Research and Work Plan* of the National Ocean Economics Project available at www.oceaneconomics.org.

greater industrial detail than was available from the other sources, and those appropriate to the ocean were selected.

Table 1 shows the industry name and several different classification schemes. The one, two,

Table 1
Industry Structure of the Ocean NIPA Account

Industry Name	SIC1	SIC2	SIC3	SIC4	NAICS2	NAICS4	NAICS6	EC97	I/O Ind 1	I/O Ind 2	I/O Prod 1	NOEP	BEA CLASS	CE Class	EST TYPE
Ag-For-Fish	0				11							Living Resources	S1	CD	IND
Commercial Fishing	0	09			11	1141			3.0002		3	Living Resources	S1	CD	IND
Commercial Fishing	0	09	091		11	1141						Living Resources	S1	CD	IND
Finfish Fishing	0	09	091	0912	11	1141	114111					Living Resources	S1	CD	IND
Shellfish Fishing	0	09	091	0913	11	1141	114112					Living Resources	S1	CD	IND
Other Fishing	0	09	091	0919	11	1141	114119					Living Resources	S1	CD	IND
Fish Hatcheries	0	09	091	0921	11	1125						Living Resources	S1	CD	IND
Finfish Farming	0	02	027	0273	11	1125	112511					Living Resources	S1	CD	IND
Other Aquaculture		02	027	0273	11	1125	112519					Living Resources	S1	CD	IND
Shellfish Farming	0	09	091		11	1125	112512					Living Resources	S1	CD	IND
Mining	1				24							Minerals			
Oil & Gas	1	13	131	1311	21	2111	211111		8.0001			Minerals	S1	CS	GEO
Oil Products						2111	211111					Minerals			GEO
Natural Gas						2111	211111					Minerals			GEO
Natural Gas Liquids	1	13	132	1321	21	2111	211112					Minerals	S1		GEO
Oil & Gas Drilling	1	13	138	1381	21	2111	213111		11.0601	12.0215		Minerals	S1	CS	GEO
Oil & Gas Explore Services	1	13	138	1382	21	2131	213112		11.0602			Minerals	S1	CS	GEO
Geophysical Surveys	1	13	138	1382	54	5413	54136					Minerals	S1	CS	GEO
Other Exploration Services	1	13	138	1382	21	2131	213112					Minerals	S1	CS	GEO
Oil & Gas Services NEC	1	13	138	1382	21	2131	213112					Minerals	S1	CS	GEO
Nonmetallic Minerals	1	14	138	1382	21	2123						Minerals	S1		GEO
Crushed Limestone	1	14	142	1422	21	2123	212312		9.0004			Minerals	S1	CS	GEO
Sand & Gravel	1	14	144	1442	21	2123	212321		9.0002			Minerals	S1	CS	GEO
Construction	1											Construct & Rehab			
Industrial Nonbuilding Structure	1	16	162	1629	23	2349	23493					Construct & Rehab	S2		GEO

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Industry Structure of the Ocean NIPA Account

Industry Name	SIC1	SIC2	SIC3	SIC4	NAICS2	NAICS4	NAICS6	EC97	I/O Ind 1	I/O Ind 2	I/O Prod 1	NOEP	BEA CLASS	CE Class	EST TYPE
Dredging	1	16	162	1629	23	2349	234990	424				Construct & Rehab			GEO
Pile Driving Contractors	1	16	162	1629	23	2349	234990	429				Construct & Rehab			GEO
Ship Painting	1	16	162	1629	23	2349	234990	575				Construct & Rehab			IND
Harbor & Port Construction	1	16	162	1629	23	2349	234990	373				Construct & Rehab			IND
Marine Construction	1	16	162	1629	23	2349	234990	374				Construct & Rehab			IND
Oilfield Construction	1	16	162	1629	23	2349	234990	385				Construct & Rehab			IND
Pipeline Construction	1	16	162	1629	23	2349	234990	353				Construct & Rehab			GEO
Manufacturing	2														
Animal Feeds	2	20	204	2048	31	3111	311111					Indirect		CD	
Animal & Marine Fats & Oils	2	20	207	2077	31	3116	311613					Living Resources		CD	GEO
Canned & Cured Seafoods	2	20	209	2091	31	3117	311711		14.0700			Living Resources		CD	IND
Fresh or Frozen Packaged Fish	2	20	209	2092	31	3117	311712					Living Resources		CD	IND
Inorganic Chemicals (Nat Gas Liquids)	2	28	281	2819	21	2111	211112					Indirect		CD	
Medicinal Chemicals & Botanical Prods	2	28	283	2833	32	3254	325411					Indirect		CD	
Surface Active Agents	2	28	284	2843	32	3256	325613					Indirect		CD	
Chemicals NEC (Paint & Coating)	2	28	289	2899	32	3255	32551					Indirect		CD	
Woven products	2	22	221	2211	31	3132	31321					Indirect		CL	
Cordage & Twine	2	22	229	2298	31	3144	314491		17.0900			Indirect		CL	
Mens & Boys Clothing NEC	2	23	232	2329	31	3152	315228					Indirect		CL	
Women & Girls Outerwear NEC	2	23	233	2339	31	3152	315239					Indirect		CL	
Children's Outerwear NEC	2	23	236	2369	31	3152	315228					Indirect		CL	
							315229								
Canvas & related products	2	23	23	2394	31	3149	314912					Indirect		CL	
Furniture & Fixtures NEC	2	25	249	2599	33	3371	337127					Indirect		CL	
Newspaper Publishing	2	27	271	2711	51	5111	511111					Indirect		CS	
Paints, Varnishes, etc.	2	28	285	2851	32	3244	32551					Indirect		CL	

Table 1
Industry Structure of the Ocean NIPA Account

Industry Name	SIC1	SIC2	SIC3	SIC4	NAICS2	NAICS4	NAICS6	EC97	I/O Ind 1	I/O Ind 2	I/O Prod 1	NOEP	BEA CLASS	CE Class	EST TYPE
Nonferrous Wire Drawing	3	33	335	3357	33							Indirect		CL	
Other Aluminum Rolling	3	33	335	3357	33	3313	331319					Indirect			
Copper Wire Drawing	3	33	335	3357	33	3314	331422					Indirect			
Other Nonferrous Wire Drawing	3	33	335	3357	33	3314	331491					Indirect			
Fiber Optic Cable Manufacturing	3	33	335	3357	33	3359	335921					Indirect			
Other Comm & Energy Manufacturing	3	33	335	3357	33	3359	335929					Indirect			
Copper Foundaries	3	33	336	3366	33	3315	331525					Indirect		CL	
Hardware, NEC	3	34	342	3429	33							Indirect		CL	
Other Misc. Fabricated Metals Products	3	34	342	3429	33	3329	332999					Indirect			
Other Metal Container Mfg	3	34	342	3429	33	3324	332439					Indirect			
Bolt, Nut, Screw, Rivets & Washers	3	34	342	3429	33	3327	332722					Indirect			
Other Motor Vehicle Parts Mfg	3	34	342	3429	33	3363	336399					Indirect			
Other Metal Valve & Pipe Parts	3	34	342	3429	33	3329	332919					Indirect			
Showcases, Partitions, Shelves, Lockers	3	34	342	3429	33	3372	337215					Indirect			
Other Hardware	3	34	342	3429	33	3372	33721					Indirect			
Fabricated Structural Sections	3	34	344	3441	33	3323	332312					Indirect		CL	
Fabricated Plate Work	3	34	344	3443	33							Indirect		CL	
Plate Work	3	34	344	3443	33	3323	332313					Indirect			
Heavy Gauge Metal Tanks	3	34	344	3443	33	3324	33241					Indirect			
Heating Equipment (part)	3	34	344	3443	33	3334	333414					Indirect			
Prefabricated Metal Buildings	3	34	344	3448	33	3323	332311					Indirect		CL	
Iron & Steel Forgings	3	34	346	3462	33	3321	332111					Indirect		CL	
Ammunition	3	34	348	3483	33	3329	332993					Indirect		CL	
Ordinance & Accessory NEC	3	34	348	3489	33	3329	332995					Indirect		CL	
Misc Fabricated Wire	3	34	349	3496	33							Indirect		CL	

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Table 1
Industry Structure of the Ocean NIPA Account

Industry Name	SIC1	SIC2	SIC3	SIC4	NAICS2	NAICS4	NAICS6	EC97	I/O Ind 1	I/O Ind 2	I/O Prod 1	NOEP	BEA CLASS	CE Class	EST TYPE
Industrial Truck, Tractor, etc. machinery	3	34	349	3496	33	3339	333924					Indirect			
Other Fabricated Wire Products	3	34	349	3496	33	3326	332618					Indirect			
Misc Fabricated Products	3	34	349	3499	33							Indirect		CL	
Showcases, Partitions, Shelves, Lockers	3	34	349	3499	33	3372	337215					Indirect			
Motor Vehicle Seating	3	34	349	3499	33	3363	33636					Indirect			
Powder Metallurgy	3	34	349	3499	33	3321	332117					Indirect			
Other Metal Container Mfg	3	34	349	3499	33	3324	332439					Indirect			
Hardwar Mfg	3	34	349	3499	33	3325	33251					Indirect			
Other Metal Valve & Pipe Parts	3	34	349	3499	33	3329	332919					Indirect			
Other Misc. Fabricated Metals Products	3	34	349	3499	33	3329	332999					Indirect			
Internal Combustion Engines NEC	3	35	351	3519	33							Indirect		CL	
Other Motor Vehicle Parts Mfg	3	35	351	3519	33	3363	336399					Indirect			
Other Engine Equipment	3	35	351	3519	33	3361	333618					Indirect			
Construction Machinery	3	35	353	3531	33							Indirect		CL	
Railroad Rolling Stock	3	35	353	3531	33	3365	33651					Indirect			
Overhead Travelling Hoists	3	35	353	3531	33	3339	333923					Indirect			
Construction Machinery	3	35	353	3531	33	3331	33312					Indirect			
Conveyors	3	35	353	3535	33	3339	333922					Indirect		CL	
Industrial Tractors	3	35	353	3537	33							Indirect		CL	
Industrial Truck, Tractor, etc. machinery	3	35	353	3537	33	3339	333924					Indirect			
Other Misc. Fabricated Metals Products	3	35	353	3537	33	3329	332999					Indirect			
Other Metal Container Mfg	3	35	353	3537	33	3324	332439					Indirect			
Food Product Machinery	3	35	355	3556	33	3332	333294					Indirect		CL	
Pumps	3	35	356	3561	33	3399	339911					Indirect		CL	
Industrial Controls	3	36	362	3625	33	3353	335314					Indirect		CL	
Vehicular Lighting	3	36	364	3647	33	3363	336321					Indirect		CL	

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Industry Structure of the Ocean NIPA Account

Industry Name	SIC1	SIC2	SIC3	SIC4	NAICS2	NAICS4	NAICS6	EC97	I/O Ind 1	I/O Ind 2	I/O Prod 1	NOEP	BEA CLASS	CE Class	EST TYPE
Equipment															
Radio/TV Communication Equipment	3	36	366	3663	33	3342	33422					Indirect		CL	
Ship Building & Repair	3	37	373	3731	33	3366	336611					Transportation		CL	IND
Boat Building & Repair	3	37	373	3732	33	3366	336612					Tourism & Recreation			GEO
Search and Navigation Equipment	3	38	381	3812	33	3345	334511					Transportation			IND
Sporting Goods	3	39	394	3949	33	3399	33992					Tourism & Recreation		CL	IND
Transporation	4											Transportation			
Local & Interurban Passenger Transit	4	41										Transportation		CS	
Public Warehousing	4	42										Transportation	D1	CS	
Refrigerated Warehousing	4	42	422	4222	49	4931	49312					Transportation		CS	
General Warehousing	4	42	422	4225	49	4931	49311					Transportation		CS	
Water Transportation	4	44							65.0400			Transportation	S2		GEO
Deep Sea Foreign Freight	4	44	441	4412	48	4831	483111					Transportation	S2		IND
Deep Sea Domestic Freight	4	44	442	4424	48	4831						Transportation	S2	CD	IND
Coastal & Great Lakes Freight	4	44			48	4832	483211					Transportation	S2		IND
Water Transportation Services	4	44	446									Transportation	S2	CD	GEO
Deep Sea Passenger	4	44	448	4481	48	4831	483112					Transportation	S2	CD	GEO
Coastal & Gt Lakes Passengers	4	44	448	4481	48	4831	483114					Transportation	S2	CD	GEO
Coastal & Gt Lakes Ferries	4	44	448	4482	48	4831	483114					Transportation	S2	CD	GEO
Water Passengers NEC	4	44	448	4489	48	4831						Transportation	S2	CD	GEO
Scenic & Sightseeing	4	44	448		48	4872	48721					Transportation	S2	CD	GEO
Water Taxis	4	44	448		48	4832	483212					Transportation	S2	CD	GEO
Marine Cargo Handling	4	44	449		48							Transportation	S2	CD	IND
Dock & Pier Operations	4	44	449	4491	48	4883	48831					Transportation	S2	CD	GEO
Other Cargo Handling	4	44	449	4491	48	4883	48832					Transportation	S2	CD	GEO
Tow & Tugboat Services	4	44	449	4492	48	4888	48883					Transportation	S2	CD	IND
Marinas	4	44	449	4493	71	7139	71393					Transportation	S2	CD	GEO
Water & Transport Services NEC	4	44	449	4499								Transportation	S2	CD	GEO

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Industry Name	SIC1	SIC2	SIC3	SIC4	NAICS2	NAICS4	NAICS6	EC97	I/O Ind 1	I/O Ind 2	I/O Prod 1	NOEP	BEA CLASS	CE Class	EST TYPE
Air, Rail, and Boat Rentals	4	44	449		53		532411					Transportation	S2	CD	GEO
Port & Harbor Operations	4	44	449		48	4883	48831					Transportation	S2	CD	GEO
Navigational Services to Shipping	4	44	449		48	4833	48333					Transportation	S2	CD	IND
Other Services to Water Transport	4	44	449		48	4833	48339	65.0600				Transportation	S2	CD	GEO
Crude Petroleum Pipelines	4	46	461	4612	48	4861	48611					Transportation			GEO
Transportation Services	4	47										Transportation		CS	GEO
Natural Gas Pipelines	4	49	492	4922	48	4832	48321					Transportation			GEO
Communication	4	48										Indirect		CS	
Communication Services NEC	4	48	489	4899								Indirect	S2		
Ship to Shore Communications	4	48	489	4899	51	5133	51339					Indirect	S2		
Electric, Gas, Sanitary Services	4	49										Indirect		CS	
Trade	5											Indirect			
Wholesale-Durables	5	50										Indirect		CS	
Wholesale-Nondurables	5	51										Indirect		CS	
Building Materials Stores	5	52	521	5211	44	4441						Indirect	D2	CS	
Home Centers	5	52	521	5211	44	4441	44111					Indirect			
Other Building Materials	5	52	521	5211	44	4441	44119					Indirect			
Department Stores	5	53	531	5311	45	452	455211					Indirect	D2	CS	
Other Gen. Merchandise Stores							45299					Indirect			
Food Stores	5	54			44							Indirect	D2	CS	
Meat & Fish Markets	5	54	542	5421	44							Indirect	D2		
Seafood Markets	5	54			44	4452	44522					Living Resources	D2		IND
Auto Dealers	5	55			44							Indirect	D2	CS	
Boat Dealers	5	55	555	5551	44	4412	441222					Tourism & Recreation	D2		GEO
Apparel and Accessory Stores	5	56			44	4481						Indirect	D2	CS	
Furniture Stores	5	57			44	4422	44221					Indirect	D2	CS	
Eating & Drinking Places	5	58	581	5812	72	722						Tourism &	D2	CS	GEO

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Industry Name	SIC1	SIC2	SIC3	SIC4	NAICS2	NAICS4	NAICS6	EC97	I/O Ind 1	I/O Ind 2	I/O Prod 1	NOEP	BEA CLASS	CE Class	EST TYPE
												Recreation			
Misc Retail	5	59		45								Indirect	D2	CS	
FIRE												Indirect			
Depository Institutions	6	60		52	5221							Indirect		CS	
Nondepository Instititions	6	61		52	5222							Indirect			
Security & Commodity Brokers	6	62		52	5231							Indirect		CS	
Fire, Marine & Casualty Insurance	6	63	633	6331	52	5241	524126					Indirect	D2	CS	
Insurance Agents	6	64		52	524							Indirect		CS	
Real Estate	6	65		53	531							Indirect	D2	CS	
Services	7														
Hotels & Lodging Places	7	70	701	7011	72	7211			72.0101			Tourism & Recreation	D2	CS	GEO
Receational Vehicle Parks & Campsites	7	70	703	7033	72	7212						Tourism & Recreation	D2	CS	GEO
Personal Services	7	72										Indirect		CS	
Business Services	7	73										Indirect		CS	
Automotive Repair	7	75										Indirect		CS	
Motion Picture Theaters	7	78	783									Indirect	D2	CS	
Misc Amusement & Recreation Services	7	79	799									Indirect	D2	CD	
Recreation Goods Rental					53	5322	532292					Tourism & Recreation	D2		GEO
Health Services	8	80										Indirect		CS	
Legal Services	8	81										Indirect		CS	
Colleges & Universities	8	82	822		61	6113	61131					Research	S2		IND
Social Services	8	83										Indirect		CS	
Membership Organizations	8	86	862				81392					Indirect	D1	CS	
Civic, Social & Fraternal Organizations	8	86	864				81341					Indirect	D1	CS	
Museums, Zoos, etc	8	84										Tourism & Recreation	D1	CS	GEO
Zoos, Aquaria	8	84	842	8422	71	7121						Tourism & Recreation	D1	CS	GEO
Architecture & Engineering Services	8	89	891									Indirect	D1		

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Industry Structure of the Ocean NIPA Account

Industry Name	SIC1	SIC2	SIC3	SIC4	NAICS2	NAICS4	NAICS6	EC97	I/O Ind 1	I/O Ind 2	I/O Prod 1	NOEP	BEA CLASS	CE Class	EST TYPE
Noncommercial Educ, Scien, Institutions	8	89	892									Research	D1		IND
Govt & Govt Enterprises	9											Government			IND
Federal Government												Government			IND
State Governments												Government			IND
Local Governments												Government			IND

three and four digit Standard Industrial Classification (SIC)[2] codes are shown. This taxonomy of industries is being replaced by the North American Industrial Classification System (NAICS), a complete revision of the industrial classification which was necessitated both by a number of changes in the economy and the need to develop a common classification system for the United States, Canada and Mexico in order to implement the North American Free Trade Agreement. NAICS codes are six-digit codes. Many are consistent with the SIC, but many SIC classes have been subdivided in the NAICS.

Thus many entries in Table 1 have both SIC and NAICS codes, while others are coded in only one system or the other. These cases are generally those in which the NAICS provides additional detail over the SIC; in these cases, the NAICS coded industries may still be summed to equal SIC coded industry at the three-digit level or lower. In addition to the SIC and NAICS codes, the classification codes from the Bureau of Economic Analysis Benchmark Input/Output Tables are shown. These codes show the appropriate industry and/or product codes for each case.

Five other classifications are shown for use in this project:

! EC 97. The Economic Census uses an additional level of industrial detail for certain industries, particularly the construction sector. These codes designate the type of construction projects within the industries.

! The NOEP code shows the industry group developed for the National Ocean Economics Project.

! The BEA Code shows whether the industry was specifically included in the 1972 BEA study, and whether the industry was connected to the ocean by Supply (S) or Demand (D). Supply-related industries were subdivided into those which rely on extracting ocean resources (S1) or which depend on physical contact with the ocean (S2). Demand-related industries were those divided into those which were complements of the ocean (D1) or which were related by geographic proximity (D2).

! The Coastal Economy codes derived from Luger show whether an industry is coastal dependent (CD), coast-linked (CL), or coastal service (CS).

! The Estimation Type indicates whether the principal estimation of the values can be done using industry data alone (IND) or whether the industry data must be disaggregated by geography in order to identify those components associated with the ocean (GEO). These categories are discussed further in the next section.

3. Approaches to Estimating Gross Product Originating.

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[2] The 1987 version of the SIC was used.

Estimation of GPO with respect to the ocean requires a shift in perspective from the normal way in which economic activity is measured. Rather than organizing the data by what is produced, as the SIC and NAICS do, this project requires organizing the data according to one input. In some cases, that input is directly tied to the output (e.g. commercial fisheries). In these cases, the ocean sector is coincident with the industry sector. In other cases, the ocean is a more indirect input and a sector's ties to the ocean is purely a function of geography. Examples include tourism and oil and gas production. These different approaches to estimation are indicated in the EST TYPE column in table 1.

The ability to estimate GPO for an ocean-defined sector depends on the level of detail in the definition of the industry. In a few cases this can be done at a relatively aggregate level (fisheries) In some other cases, this requires data at the four digit (SIC) or six digit (NAICS) level. (.e.g. dredging contractors). In many cases, even this level of classification is insufficient. (canvas products includes both marine and nonmarine products).

For a geography-defined sector, the problem is to get to the level of geography nearest the ocean. Ideally, this is done by using data at the municipal level or even below the municipal level. Two barriers prevent the use of such data in many cases. One is that most economic data series are not available below the county or Metropolitan Statistical Area level. The other is that strict rules regarding the disclosure of data that could identify a single firm prohibit publishing data at a level of industrial and geographic detail sufficient to meaningfully identify the ocean sectors in many cases.

A third level of problems exists for many industries. Ocean-related economic activity may be only a portion of the sales of a given firm or industry. For example, hotels, particularly in metropolitan areas like Los Angeles, may provide services to tourists who go to the beach, to museums, the Dodgers, or to Disneyland.. Thus the ocean component of the output of the hotel industry cannot be determined by either industry or geographic characteristics alone, but must be examined through the characteristics of the customers. A similar problem exists for the construction industry, since many firms that specialize in heavy construction may do both ocean and non ocean-related work.

In such cases, it is possible to distinguish between a *coastal* component and an *ocean* component to economic activity. Thus, through geographic disaggregation, it is possible to identify a coastal component to the industry which is related solely to the geographic location of the industry. However, additional detail is needed to identify the *ocean* component of economic activity. Again using hotels as an example, if the patterns of tourist behavior are known, for example through visitor surveys, then it may be possible to separate the proportion of time spent at the beach v. going to Disneyland and thus more realistically reflect the actual ocean-related economic activity of the hotel industry.

These three different issues give rise to what may be termed three types of estimates based on the type of data used.

Type 1 estimates are those which can be made using publicly available data only. Such estimates are generally confined to those sectors whose connection to the ocean is clear enough that the industry definition alone is sufficient.

Type 2 estimates are those which can be made using public data sets, but which require use of those data sets at a level of detail that is not normally available to the public. Data such as the individual firm records contained in the Economic Census need to be examined in order to get to the level of industrial or geographic detail sufficient to identify the ocean (or coastal) components.

Type 3 estimates are those which require information outside of the usual public economic data series in order to prepare meaningful estimates.

In addition to the *data* type, there is also the issue of the *estimation technique*. Three different approaches to estimation can be identified at this point:

First order estimates of economic activity are those that come directly from the public data sets. In the estimations of GPO contained in this paper, some data such as that for fisheries, are directly published in the Census of Agriculture and are included here. Employment data for most industries can be directly measured from the data sources associated with the type of data used.

Second order estimates are those which must be estimated from data at a high level of detail (for example four digit (SIC) or six digit (NAICS) using data from a lower level of detail (two or four digit industrial data). Most of the estimates below use this approach, which estimates the GPO in a given detailed sector as a function of the national GPO estimates for the two-digit SIC code industry. See below for more detail.

Third order estimates use original primary source data to build from the "bottom up" rather than the "top down". For those industries which use Type 2 data (public data, not publicly available) it is possible to construct estimates of value added (gross product originating) by using the wage and salary data reported in the original source records and then adding in the components (taxes, interest, profits) in the same manner as the Census Bureau and BEA do for the more aggregate publicly available data.

The combination of data types and estimation orders can be summarized in Table 2:

Table 2			
Estimation Order			
	First	Second	Third
Type 1			

(Left side of table labeled vertically: Data Type)

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	Type 2			
	Type 3			

The estimates in this paper all use Type 1 data and are first or second order estimates. As will be seen, in order to fully measure the economic value of the ocean in a NIPA framework, it will be necessary to use all three types of data and all three approaches to estimation.

4. Preliminary Estimates of Gross Product Originating for 1997

Table 3 presents estimates of GPO for several industries based on the 1997 Economic Census and on estimates of GPO released by two-digit industries for the U.S. by the BEA for the period 1969-1998 by BEA. These estimates are derived using several different approaches:

Estimates for the domestic harvest of fisheries and for the retail value of fisheries are first order estimates, taken directly from the Census of Agriculture.

Two approaches to estimating GPO are used for other sectors. Estimate 1 (see Equation 1) uses the ratio of payroll to GPO at the two digit SIC level from the BEA data to estimate GPO from the payroll data reported in the Economic Census. Estimate 2 (see Equation 2) disaggregates the GPO reported by BEA to the ocean sector by the proportion of total payroll in that sector.

$$GPO_i = \left(\frac{GPO_s}{PAY_s} \right) PAY_i \ \textbf{(1)}$$

$$GPO_i = GPO_s \left(\frac{PAY_i}{PAY_s} \right) \textbf{(2)}$$

Where:

GPO_i = Gross Product Originating from Industry i as defined in Table 3 from the Economic Census.

GPO_s = Gross Product Originating from the broader sector as defined by BEA.[3]

PAY_i =Wages and Salaries in industry i. from the Economic Census.

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[3] Note that the terminology used here is somewhat arbitrary. The "industry" in this case is the ocean-related industry, which is defined at a rather high level of detail. The "sector" is actually the two-digit industry for which BEA reports the GPO data. Since the BEA data is for a broader group of industries, the term "sector" is used to avoid confusion.

$$PAY_s = \text{Wages and Salaries in industry i. from BEA.}$$

These are all second order estimates using Type 1 data.

Certain other adjustments are also required. The "ocean share" for most industries is assumed to be 100%, but in some cases an ocean share must be estimated. For those industries whose ocean share is dependent on geography, the Economic Census data geographic series was used to extract the data for the coastal counties.[4]. These are designated as CC in table 3. For the oil and gas sector, the ocean share was estimated by using production statistics for the offshore from the Minerals Management Service and total production statistics for the U.S. from the Energy Information Administration to compute an ocean share. Note that this method excludes production outside of the federal waters and so is somewhat low. This share of production was also applied to the oil and gas service industries for preliminary estimation purposes. However, oil and gas service activity in any given year is probably not directly proportional to production activities.

Two broad sectors defined for the National Ocean Economics Project are excluded from Table 3. One is the government sector. A separate paper covering government expenditures on the ocean are under development. The scientific research sector is also excluded because the Economic Census data does provide sufficient detail to distinguish the marine research sector from other types of research institutions.

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[4] See the NOEP Research Plan for a definition of the coastal counties used in the study.

Table 3
Preliminary Estimates of Ocean Gross Product Originating: 1997
Billions of dollars

NOEP Sector	NAICS	SIC 87	INDUSTRY	GPO EST1	GPO EST 2	Ocean %	PAY EC97	PAY/GPO 97	SHARE PAY
Constr	234120	16	Bridge & Tunnels-marine	$2.46	$2.46	100%	$1,629.194	1.51	0.717%
Constr	234990	16	All other heavy constr-marine	$0.60	$0.60	100%	$397.125	1.51	0.175%
Constr	234990	16	Dredging	$0.45	$0.45	100%	$300.020	1.51	0.132%
TOTAL CONSTRUCTION				**$3.51**	**$3.51**				
Living Res	311711	20	Canned & Cured Seafood	$0.23	$0.23	100%	$121.835	1.88	0.192%
Living Res	311712	20	Fresh & Frozen Seafood	$1.47	$1.46	100%	$780.770	1.88	1.228%
Living Res	1141	09	Domestic Harvest*	$1.94		100%			
Living Res			Retail Trade- Fisheries*	$17.27		100%			
TOTAL LIVING RESOURCES				**$20.91**					
Minerals	211111	13	Oil & gas production	$4.29	$4.29	20%	4968.722	4.31	4.6%
Minerals	211112	13	Natural Gas Liquids	$0.47	$0.47	20%	541.593	4.31	0.5%
Minerals	213111	13	Oil & Gas Drilling	$1.65	$1.65	20%	1918.086	4.31	1.8%
Minerals	213112	13	Other Exploration Services	$3.13	$3.13	20%	3628.416	4.31	3.4%
TOTAL MINERALS				**$9.54**	**$9.54**				
Tourism & Rec	7211	70	Accomod (exc Casinos) Coastal	$21.51	$21.54	CC	$12,291.063	1.75	30.51%
Tourism & Rec	7121	86	Zoos and Nature Parks-Coastal	$0.78	$0.78	CC	$478.508	1.62	1.20%
Tourism & Rec	336612	37	Boat Building	$1.17	$1.17	100%	$1,025.531	1.14	2.096%
Tourism & Rec	811490	37	Boat Repair-Coastal	$0.04	$0.04	CC	$33.351	1.14	0.068%
Tourism	441222	55	Boat Dealers	$0.56	$0.56	CC	321.276	1.75	0.08%

Table 3

Table 3
Preliminary Estimates of Ocean Gross Product Originating: 1997
Billions of dollars

NOEP Sector	NAICS	SIC 87	INDUSTRY	GPO EST1	GPO EST 2	Ocean %	PAY EC97	PAY/GPO 97	SHARE PAY
& Rec									
TOTAL TOURISM & RECREATION				$24.05	$24.08				
Transp	235210	16	Ship Painting	$0.09	$0.09	100%	$61.573	1.51	0.027%
Transp	483112	44	Passenger	$0.60	$0.60	100%	$380.310	1.59	4.550%
Transp	483111	44	Freight	$1.34	$1.34	100%	$841.598	1.59	10.069%
Transp	334511	38	Search & Navigation Equip	$10.36	$10.34	100%	$9,422.203	1.10	19.120%
Transp	336611	37	Ship Building	$3.81	$3.79	100%	$3,338.358	1.14	6.823%
Transp	4861	48	Pipeline Transport of Crude Oil	$0.16	$0.16	20%	479.51	1.67	2.97%
Transp	4862	48	Pipeline Transport of Nat. Gas	$0.67	$0.67	21.5%	1870.95	1.67	11.59%
Transp	4872	48	Water Scenic Trips	$0.47	$0.47	100%	282.848	1.67	1.75%
Transp	48831	48	Port & Harbor Operations	$0.40	$0.40	100%	237.681	1.67	1.47%
Transp	48832	48	Marine Cargo Handling	$3.23	$3.23	100%	1941.364	1.67	12.03%
Transp	48833	48	Navigational Services	$0.63	$0.63	100%	376.739	1.67	2.33%
Transp	48839	48	Other Support Activities	$0.35	$0.35	100%	207.487	1.67	1.29%
TOTAL TRANSPORTATION				$22.11	$22.07				
TOTAL				$80.13	$80.12				

* Estimates derived directly from the Census of Agriculture

There are a number of observations which may be made from the data in Table 3, most of which point to the directions for future research which will permit further refinement of the estimates.

1. There is little difference between Estimation technique 1 and technique 2. The major difference is in ship building, and this needs to be further examined. Since U.S. ship building is done primarily for the Navy, there is a need to compare estimates based on GPO with procurement data from the federal budget.

2. The largest single industry estimate is for accommodation (except casinos). This was a purely coastal (geographic) estimate and so includes a large proportion of non-ocean related uses. This is the classic example where Type 3 data is needed to prepare appropriate recommendations. The tourism and recreation sector excludes eating and drinking places. Since these serve both local and tourist populations, it was determined that it would be best to await additional data rather than relying only on geographic data.

4. The largest single industry in the data is search and navigation equipment. This sector has a very large payroll because of the skilled workers needed to produce the electronic equipment and software used in this sector. Wages and salaries are also the principal input to production of these goods.

5. The minerals estimates exclude the value of offshore production in the state waters of Texas, Louisiana, and Alaska. The oil and gas service industry estimates must be matched to actual levels of activity. The implication of the state waters exclusion is that the estimates for production are too low. The implication of the other adjustment is unknown.

6. Both the passenger and freight transportation data is comprised of both ocean and Great Lakes data. The Great Lakes data needs to be extracted to estimate the ocean data.

5. Future Research

The NOEP is currently attempting to develop more refined estimates for the recreational boating sector in Maine, and will soon begin to examine the minerals sector nationwide and in the principal offshore oil and gas producing states. Proposals to estimate the value of the transportation sector nationwide and in Rhode Island are currently under consideration, along with a proposal to examine the tourism and recreation sector in California. Pending additional funding, the Project will develop further refinements for all relevant sectors and industries. Much of the effort in these studies will be devoted to developing the data sets needed for type 3 data. These include tourism and recreation estimates by visitor days, oil and gas industry data, and transportation data.

There are three additional steps needed to complete the estimation of the national income account for the ocean. These will be the subject of future NOEP Working Papers.

1. Estimation of regional-data. This will be done at the state level for all coastal states and

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at the county level where disclosure rules permit.

   2. Historical estimates. The GPO series for 1997 shown here can be extended back to 1972 using the recently released GPO data. This will probably be done only for the Economic Census years in order to take advantage of the detailed data available in these years.

   3. Development of Type 2 data from the Economic Census and BEA to refine the estimates presented here.